McGraw-Hill Publishing Company, Inc. MAY, 1934 Price 35c. per copy

AVIATION

The Oldest American Aeronautical Magazine

This is the first of a new series of "Clippers" which will shortly be placed in service on Pan American Airways routes between North and South America. It is the largest plane ever built in the United States—and the first to be designed specifically for trans-Atlantic service. It is powered by four Hornets, each rated at 670 h.p. at 5000 ft.

IN THIS ISSUE

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AVIATION

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THE OLDEST AMERICAN AERONAUTICAL MAGAZINE

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Contents for May, 1934

Volume 30 Number 5

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Sleep via AMERICAN AIRWAYS

Over the Mountains and Across the Desert..

WRIGHT Cyclones power American Airways' fleet of Curtiss-Wright Condor Sleeping Planes. The first installation of this deluxe equipment was recently made on the Dallas-Fort Worth and Los Angeles Division of American Airways.

Over the mountains and across the desert at 160 to 190 miles per hour. Luxurious berths for night flight . . . spacious club chairs for day flight, are features that permit complete relaxation and eliminate the fatigue which usually accompanies extensive transcontinental travel.

The new Curtiss-Wright Condor Sleeping Planes are powered by two Wright "Cyclones" which develop 1430 h.p. at 1950 revolutions per minute. With both engines in operation, the planes have a service ceiling of more than 18,000 feet and a cruising radius of 725 miles, with a gasoline capacity of 375 gallons. They are capable of completing a take-off with a single engine and climbing to 8,000 feet altitude on one engine.

American Airways operates millions of miles annually with Wright Cyclone-powered equipment over its Coast-to-Coast, Canada-to-Mexico System. The new Sleeper Planes are the latest equipment designed to provide the public with maximum air travel facilities.

WRIGHT
AERONAUTICAL CORPORATION
PATERSON NEW JERSEY
A DIVISION OF CURTISS-WRIGHT CORPORATION

Powered by
WRIGHT CYCLONE
715 · H.P. ENGINES

CURTISS-WRIGHT CONDOR *Sleeping-Plane*

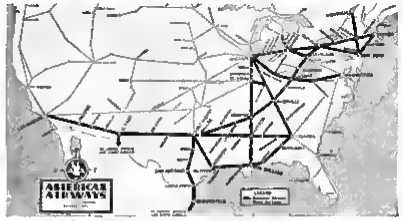
The latest Innovation of AMERICAN AIRWAYS

AMERICAN Airways is the world's first airline to introduce complete Flying Sleepers. The planes are an improved type of Curtiss-Wright Condor, powered by two Wright Cyclone Engines, with a top speed of 190 and a cruising speed of 160 m.p.h. They carry twelve passengers, two pilots and a steward.

The spacious upper and lower berths of these ultra-modern airliners are one inch longer than those of the standard American sleeping car. They can be quickly converted in flight or on the ground into wide and comfortable lounge chairs. Each berth is as fully equipped as the deluxe compartments of a transcontinental train or ocean liner. The first two planes of a fleet of six Curtiss-Wright Condor Sleepers were recently placed in service on American Airways' division between Dallas-Fort Worth and Los Angeles. They have established a new high standard of air transportation for the personal comfort of American Airways' rapidly increasing patronage.

American Airways has purchased twenty-five Curtiss-Wright Condors during the past twelve months for use on the following divisions of its "Nationwide Network of Airlines"—Chicago-New York, New York-Boston, Cleveland-Dallas-Fort Worth, and Dallas-Los Angeles.

Curtiss-Wright Condor Sleeper Powered by Wright Cyclones



American Airways' Coast-to-Coast Network of Airlines

CURTISS-WRIGHT AIRPLANE COMPANY
ROBERTSON A DIVISION OF CURTISS WRIGHT CORPORATION **MISSOURI**

AVIATION
FOR MAY, 1934

The author, who was formerly manager of the transport section of the Aeronautical Chamber of Commerce, has discovered some fundamental principles that should be of interest to those who are charged with the duty of dressing up the ticket office windows.

Window Displays

By William E. Berchtold

MENTION window displays to any group of airline traffic representatives, advertising managers or operating executives and you'll bring out as many divergent views as you might expect to obtain through an inadvertent mention of the 'commodity dollar" among a group of economists or bankers To some traffic executives, window displays in ticket offices, travel bureaus and other street-front spots "aren't worth a tinker's dam" To many traffic representatives, they're a "pain in the neck," a malady experienced at least every two weeks when ticket office windows must be dressed up Others will tell you that well-planned window displays are the most productive drawing cards in their advertising programs Almost everyone has a definite opinion on the subject from president to office boy Perhaps the latter has been shouldered with the unwanted responsibility too often, although it seems that an office boy with a bit of imagination might do a job superior to some which have reached expensive street-front locations

All agree that it is one thing to draw crowds with a window display, but it is quite something else to sell your product through that display Turn a dozen lizards into a window facing a busy street and you'll congest traffic in five minutes but the lizard watchers may never be inspired to buy an airline ticket the next time they go somewhere. Yet it is necessary to attract attention if a display is to assure a maximum return on the money spent in its preparation

It should be interesting to pool the experiences of some of the major air lines Pan American Airways, United Air Lines, American Airways, Eastern Air Transport and Transcontinental and Western Air should provide a good cross-section of the industry's experience for such a study

Nearly everyone talks of cramped budgets as the greatest barrier to the production of worth-while window displays, the budgets for such purposes on some lines having been pared almost to the vanishing point. However, it is not always the most expensive display which draws the biggest crowds or sells the most tickets Many times the imagination of an industrious traffic man in an out-of-the-way point has produced a display of far greater drawing power than the cut-and-dried layout sent out from headquarters, and at but a fraction of the cost Most of the lines send out only basic materials from headquarters and give their local representatives an opportunity to exercise their own imagination in final preparation of each display

Selling the business man

United Air Lines has concentrated on the use of a number of attractive self-contained, built-up displays which are sufficient in themselves for the average travel bureau or ticket office window The displays have utilized color and lighting to good advantage, with actual photographs of air transport service used in preference to drawings or other art work The principal displays have been directed to the business traveler on the theory that the line obtains 80 per cent of its traffic from that group. The New York office of United Air Lines arranged a display in conjunction with the Dollar Steamship Lines which illustrates the possibilities of such cooperative endeavors With a large map as the central feature, the cross-continent service of United Air Lines was shown in conjunction with the Dollar Line's ocean services to girdle the globe by air and water for $717. The prospective customer might easily visualize himself as another Wiley Post, albeit using a bit of Magellan's technique on part of the journey What were the results? Directly, three world cruises were sold and more than a score of inquiring prospects were turned over to the Dollar Line Indirectly, the ticket office experienced a heavy fortnight of selling to passengers flying to Chicago, Kansas City, Cleveland and other points on United Air Lines many of them brought into the office for the first time by the window display

United Air Lines has long recognized the value of models for window displays. its latest window model being an attractive metal miniature of the Boeing 247 mounted on a metal stand which permits adjustment of the model in one of several flying positions A

small electric lamp in the cabin can be hooked up to provide a flashing light as an attention getter. The ordinary balsa wood models used so extensively a few years ago no longer have the drawing power that they formerly commanded. American Airways and some of the other lines have used models with whirling propellers to good advantage. The propellers can be made to whirl through use of a concealed electric fan.

The most effective models, without doubt, are those which provide a cut-away view of the airplane's interior with pilots, passengers and all facilities shown in minute detail. Imperial Airways scored a great hit with a 60-in. cut-away model of the Hannibal airliner displayed on Fifth Avenue in New York. Built in London at a cost of $125, the model drew huge crowds wherever it was displayed. Pan American Airways likewise found the cut-away models of its Clippers in great demand among travel agencies. The Pan American models, while smaller than those of Imperial Airways, proved quite as effective.

The cross section or cut-away model draws crowds almost as well as lizards, it retains attention better than lizards, and it does a selling job unequalled by most displays. It gives the prospective passenger an opportunity to see every detail of the airplane in a way which could be exceeded only by the experience of a flight in the full size airplane itself. It brings the airport to the ticket office window in a way that drawings, photographs and other devices do not achieve as well.

Transcontinental and Western Air is utilizing the cross-section cut-away idea for some of its new displays by showing a large drawing of the new Douglas transport with legends liberally distributed to direct attention to outstanding features. Such drawings, while admittedly not as effective as scale model cut-aways themselves, have the advantage of lending themselves to production in large quantities with but a fraction of the expense.

Material from model builders

Interest in models and model building has been turned to advantage in another way by T.W.A. through its tie-up with the Model Builders Guild in promotion of the new Douglas transport. Window displays in many cities featured the Douglas model building contest, the displays often being staged in co-operation with local department stores which were prepared to sell the model kits at $1.50 and $2.50 each. Department stores were ordering the kits at the rate of 1,500 to 2,000 weekly during December, with prospects of getting 100,000 contestants building the Douglas models before the closing date. The boy who bought a model kit got a generous supply of information about the new Douglas transport and the "Lindbergh Line," most of the material being designed to be as interesting and instructive to parents as well.

Three dimensional displays built up on cardboard also have been used by Transcontinental and Western Air. Most of them have been rather mechanical in treatment, featuring chiefly the route over which the company operates, with slogans designed to appeal to the business traveler. As contrasted with the United displays which use actual photographs extensively, the T.W.A. built-up displays have used art work in preference to photographs. The company has encouraged its local offices to build up special displays, and many of them have developed good ones on such special events as football games, holiday traffic movements, etc.

Posters have been used to some extent by nearly all lines. A few of them have been good, but most of them have failed to demonstrate the same drawing power which posters on similar subjects have shown in Europe. Some traffic and promotion departments feel that America is not "poster-conscious." Others say the fault is not with the public, but with the American posters which fall short of those designed by European poster artists. One point on which all are in agreement: it is impossible to get a poster used for window displays in the United States unless it is mounted on heavy board and provided with some device which will enable it to stand by itself.

Eastern Air Transport, with a budget for window displays kept at a minimum, has used mounted posters, folders and models as the principal materials for its displays. The effects obtained through most of its window displays have been decorative rather than an active attempt at a selling job. The line looks upon the cross-section cut-away model and the three-dimensional cut-away drawing with particular favor and may use them in future displays. Photographs, and particularly photographs of its transport planes on the ground with passengers boarding them, have been utilized effectively by E.A.T. to sell the public on its services.

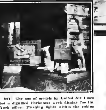
American Airways has found photographs of news-worthy passengers particularly good. One of the most effective American Airways' window displays seen in New York during the last two years featured the New York-Chicago service in a smart exhibit which portrayed an airport, with planes, passengers, etc., in miniature. An arch between the two metropolitan centers carried the story of the *speed* of the service with a distinctly modern touch.

Pan American Airways' ticket office in 42d Street, across from New York's Grand Central Terminal, has been a magnet for window shoppers for months. The Pan American displays, with one exception, have been conceived, designed, executed and installed at costs

ranging from $40 to $75 each. The one exception represented an investment of more than $700 and proved to be the premier "flop" of the series. Lacking nothing in the way of a professional touch, the most costly display graphically portrayed the technical features of the Pan American "Radio Block-Signal System" with moving electric ribbons carrying messages from a model ground communications station to a Sikorsky "Clipper" in flight and another flashing display sending messages from the plane to the ground. The backdrop showed a colorful tropical setting, with an inserted map of Pan American's extensive routes. It failed to draw public attention; the few who stopped to look at it for a second, hurried on their way after a fleeting glance. The verdict: it was too technical.

Livestock attracts

Pan American's most successful displays have looked like museum exhibits in a modern setting. Using Alaska, Ecuador, Nassau, Peru, Jamaica, Brazil, Puerto Rico, Yucatan and Colombia as central subjects for biweekly displays, the story of Pan American's services for passengers, mail and express is being put across with an exhibition of unusual objects, implements, coins, photographs, and products of the countries served. Some striking scene from each country is used for a backdrop in color to tie the entire exhibit together as a unit. Each display is designed to utilize tricks of color, lighting, movement and a sense of the unusual, the same elements which might make up a successful travelogue. There can be no doubt about the effectiveness of the best of this series of Pan American displays. Inquiries about the service double and triple during the weeks when first ranking displays are in the window. The one on Ecuador jammed such crowds about the window that a policeman finally took over the task of keeping window-gazers moving. What stopped the traffic for this display? It was an Ecuadorian monkey in a cage placed in



Above left: The use of models by United Air Lines provided a dignified Christmas week display for the New York office. Flashing lights within the cabins served to attract attention. Above, right: The most effective models are those that are large enough to provide a cut-away view of the airplane's interior showing the facilities, and Pan American Airways in this country and Imperial Airways in England have found these displays in great demand by travel agencies. Above: Transcontinental and Western Air has exhibited classic gridiron battles for material for its San Francisco office window. Three dimensional built-up display is used for a background.

With a colorful background as their central feature, Pan American Airways has found exhibits based on the products, implements, coins and unusual art objects of the countries in which it operates exceedingly effective.

the center of the exhibit. Yes, some one is bound to say, but did anyone see anything in the window except the monkey? The best answer to that is that hundreds of people came into the office and asked questions, 50 bought duplicates of a rug included in the display among many other objects, and it was one of the most active periods in the office's history for actual ticket sales. Did they buy tickets to Ecuador? No, but they bought tickets to Chicago, Panama, Brazil, Cuba and other points that ring the cash register just as loudly. Curiously enough, none of the Pan American displays have emphasized the advantages of flying which might be advanced for the edification of a business traveler, although most of the company's passengers fly for business reasons. The theory behind this seeming neglect to score a major point is this: such travelers choose the method of transportation which seems the most attractive to them and none is adverse to including the Machu Picchu or a Mayan temple or two in his itinerary if it can be arranged within the limits of time and pocketbook. The railroads have recognized this fact for years, capitalizing on such scenic wonders as the Grand Canyon, Lake Louise, and other points on or near their trunk routes.

The domestic air lines fly over or near the principal scenic wonders of the country and no line is without some high point of interest which could be made the center of an attractive travel display along the lines of Pan American's series. Exhibits built on the products and objects of art of particular states or cities also offer possibilities which have been explored only to a limited extent in displays already used.

The air express theme

Air express offers some unusually fine opportunities for window displays that sell air transportation. Most of the lines have made some use of this theme since the express services were first offered. Pan American developed an unusually successful display featuring some of the numerous articles which have been included in express shipments

on its routes. The articles, from shark hooks to baby chicks, were borrowed from New York merchants. The baby chicks proved second only to the Ecuadorian monkey as an attention getter.

One of the most disturbing factors in the preparation of window displays has been that a good window in Chicago, New Orleans or Los Angeles may be a perfect "flop" on Fifth Avenue. Likewise, some exhibits which draw crowds and attract favorable comment on Fifth Avenue may prove second-rate attractions in other parts of the country. The display which stopped traffic a year or two ago may be passed up like a dirty deuce in 1934. Window displays must be looked upon as perishable articles.

The alert builder of window displays, whether he is a traffic representative, promotion director, advertising manager, or the overburdened office boy, may find his cue to the conception of successful selling exhibits by studying the newspaper advertising, window displays, and other promotional work of the better class specialty shops and department stores in the city he is aiming to reach. If he can keep a bit ahead of the smartest display builders in a city so much the better, but he can at least study their present technique.

There is little doubt but that window displays can form a very important part of an airline's promotional effort. The lines which have devoted a reasonable amount of attention and money to such displays have found that they can count on an equitable return in dollars and cents from ticket sales. However, it is not possible to balance off each week's sales against each week's expense for window displays. Window promotion like newspaper and magazine advertising, is something of an institutional job at the present state of the industry's development. Today's ticket sales are made to prospects whose acts have been influenced by the promotion work of last month, last year, or perhaps several years of consistent plugging.

As air transportation develops and budgets are increased to carry along more vigorously such promotional work as window displays, it is more than likely that most of the displays will be conceived and sent out from the central headquarters of each company with definite instructions for installing each unit. With the present more flexible arrangement existing in most companies, the traffic personnel has a greater opportunity to demonstrate its imaginative powers within the limits of a relatively slim pocketbook.

Flaps and Cowls

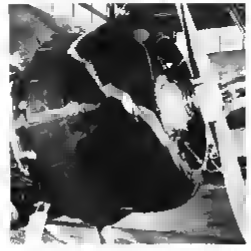
Controlled engine cooling through adjustable cowling

AMONG the many subjects touched upon by Messrs. Beisel, MacClain and Thomas, in their excellent paper "The Cowling and Cooling of Radial Air-Cooled Aircraft Engines" (presented at this year's annual meeting of the Society of Automotive Engineers in Detroit), is a study of the control of cooling air by means of trailing edge flaps applied to engine cowling of N.A.C.A. type. Several years of coordinated research by the Pratt & Whitney Aircraft Company, the Chance Vought Corporation, and the Research Division of United Aircraft & Transport Corporation, have disclosed the general principle that all-around engine efficiency and maximum airplane performance results from limiting the flow of air through a radial engine to the exact quantity necessary to maintain cylinder temperatures in the desired operating range. It is essential to force what air is admitted to the engine to flow in as close contact as possible with the cylinder fins and other cooling surfaces. The now-familiar pressure type baffling is the direct outgrowth of this work. It is of interest to note in passing that great impetus was given to this research by the cooling problems which arose during the past couple of years in connection with the development of twin-row radials.

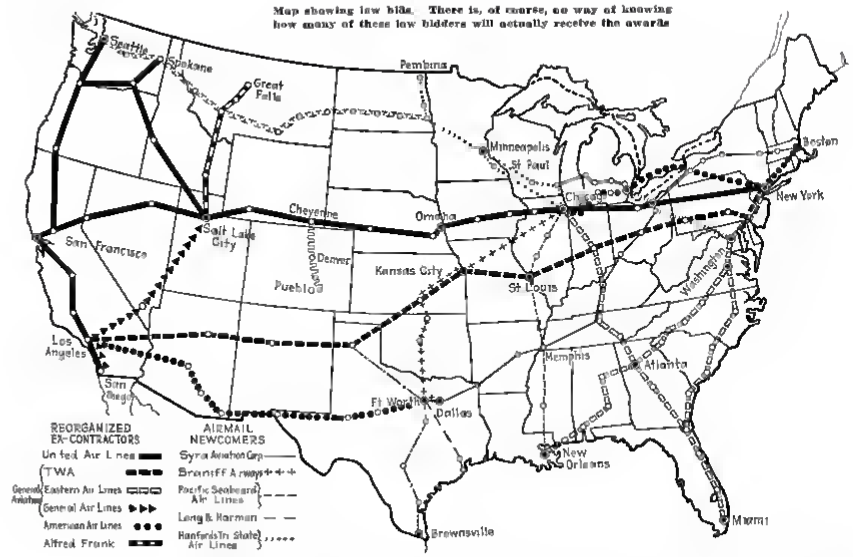
It is obvious at once that the volume of air required to cool an engine will vary considerably with the forward speed of the airplane (assuming, of course, that no auxiliary blowing device is contemplated). Thus a cowling arrangement which will give satisfactory cooling at high speed will be deficient at climbing speeds, and engine overheating will result. The most obvious solution would be to design a cowling to give adequate drag reduction and at the same time be provided with some sort of adjustable openings for the control of the flow of cooling air. Mechanical difficulties made control from the forward end of an N.A.C.A. cowl difficult so one was designed with flaps attached to the trailing edge all around. It has been found that a relatively short flap, adjustable to comparatively small angles provides a range of cooling adequate to cope with all flight conditions and all variations in weather. The cowl having a skirt composed of a series of separate flaps (see accompanying photograph) has been found to fulfill all conditions satisfactorily. The position of the flaps can be readily controlled from the cockpit. Total displacement is about 30 deg., 10 deg. below the normal inline position and 20 deg. above it. This installation was made on a Chance Vought V-70-A airplane fitted with a Hornet engine. The total cowl length was 32 in. and the cord of the flaps (included in the total length) was 9 in. The weight of the airplane was increased by 23 lb. Extending the flap to 20 deg. increased the radius of the trailing edge skirt 3 in. and increased the effective opening from 3 to 5 in. Temperature differences at high speed between the 0-deg. and the 20-deg. flap setting averaged 60 deg. F. for the cylinder head and 30 deg. F. for the cylinder bases. With flaps full open, the engine temperatures in climb were lowered by some 50 deg. F. at the heads, and the decrease in climb (attributable to the added drag of the flaps) was only about 3 per cent.

Although the experiments so far have covered only one engine and one cowling installation, and a single length of flap with a relatively small extreme angular displacement, the results obtained have been promising enough to warrant further research.

Adjustable cowl—flaps at 0 deg.



Adjustable cowl—flaps full open.



Spring Opening

Formal prelude to an air mail shuffle

HIGH NOON on April 20. A private office on the fourth floor of the old Post Office Department Building in Washington. Into the room, crowded 150 people, treading on each other's toes and posed precariously on every piece of furniture that would give a vantage-point. (One-third that number would have been a big attendance upon any previous occasion of this same order.) For the office was the office of Stephen A. Cisler, Superintendent of Air Mail, and bids for rendering temporary service on seventeen routes were about to be opened.

Among the 150, a large part of America's official and commercial air transport leadership. From the Department of Commerce Aeronautics Branch, Colonel Cone (Assistant Director of Aeronautics), Major R. W. Schroeder (in charge of air transport activities), and later in the day Director Vidal. From the commercial world, E. R. Breech, president of General Aviation; W. A. Patterson, president of United Air Lines, Lester D. Seymour, president, and R. S. Pruitt, vice-president of American Airways (now become American Airlines); Major R. H. Fleet of Consolidated Aircraft; Bedell Munro of Pennsylvania Airlines, Chester W. Cuthell, corporation counsel to aeronautical activities without number, Paul Braniff, Maj. W. B. Robertson, Col. L. H. Brittin, Clarence Chamberlin, Earl N. Findlay of U. S. Air Services, Reed M. Chambers of U. S. Aviation Underwriters, and others galore. From the Post Office Department, everybody—headed by Postmaster-General Farley and by First-Assistant Howes, Second-Assistant Branch, Superintendent Cisler, and Solicitor Crowley. From the Department of Justice, to apply the check and double-check of legality to the proceedings. Special Assistant Attorney General Holtzclaw.

Scenic design

Around a long table, with the Postmaster General at its head, the officials of the government departments. In the center of the table, 45 air mail bids, received the previous day, in a neatly-sealed package. At the foot of the table, the customary grand array of photographers, hastily loading flash bulbs and competing for the best points of view. Upon the wall just above the Postmaster General's head, a large colored poster reading "For a Quick Answer—Air Mail." On top of a bookcase beside the poster, a silver Boeing zooming up from a pedestal—relegated temporarily to the degrading function of a hatrack. The stage was set, the cast assembled, the curtain ready to rise upon another scene in aviation's tensest drama.

Following on some slight confusion occasioned by the fact that the two wall clocks within plain view seriously disagreed with each other, the packagr of bids was broken open at three minutes after twelve. Ensued the flashing of camera lights and the clicking of shutters, and at 12:07 the first bid was read—the bid of General Airlines, Inc., soon inferred by the audience to be the successor company of Western Air Express. It covered the route from Cheyenne through Denver to Pueblo and offered the rate of 39 cents a mile—

a figure a little below the maximum allowed by the specifications, but neither so high nor so low as to arouse any excitement

Price-cutting thrills

There followed the offer of TWA to carry the mail between Newark and Los Angeles by way of Kansas City for 24 cents a mile, a figure that occasioned a little stir in the crowd, but the first real evidence of astonishment came a bit later when 19 cents per mile was read off as the offer of Eastern Airlines for flying the mail from Chicago through Louisville and Atlanta to Jacksonville. Whistles and whispers swept the room, and Mr Pruitt as representative of the company lately carrying the mail over the major part of the length of that route, looked quizzical. A moment later came another 19-cent bid by the same company for the route from Newark through Atlanta to New Orleans, but this time the audience was braced for the shock.

So far there had been no competition, nor was there until after a dozen more bids had been read but when finally Braniff Airways came in with an offer of 35 cents for the same Chicago-Jacksonville route on which Eastern Airlines had offered 19 there were more murmurs of excitement. A later Braniff bid occasioned mirth rather than excitement when it appeared that the first two bids for the Amarillo-Brownsville run (by way of a large proportion of the cities in Texas) were 19¾ cents and 20 cents respectively. There were no other instances like that, and in most instances the spread of competing bids was surprising for its breadth rather than for its narrowness.

Excitement can scarcely be sustained through the reading of 45 sets of figures and itineraries of routes, but the crowd succeeded in getting a few thrills and a few laughs. There was a gasp of astonishment when Pacific Seaboard Airlines, who had never previously strayed more than a stone's throw from the ocean that gave them their name, showed up with a bid of 17½ cents a mile on the Chicago-New Orleans run. There was a chuckle and a whispered comment about "Fresh Airline Taxi" and about Amos'n' Andy when the name of the National Airline Taxi System was read as a bidder from Chicago to Pembina. There was definite surprise in every quarter when the bids of American Airlines began to be read and all anticipations regarding Mr Cord were apparently crossed off by a persistent offering of 39½ cents a mile on practically every route—the highest offer received from any source, with the exception of three of exactly that same figure from United Airlines and one on a slightly higher level from another company. Of the four independent bids made by United Airlines, however covering all their existing routes and ranging from 38 to 39½ cents, three encountered no competition. American Airlines was in the less fortunate position of having competition on seven of the eight routes for which the company made bids and in some cases competition from a number of sources. Ironically enough, the only American bid on April 20 that was completely unchallenged was the only one on which the company departed from its flat 39½ cent policy and offered a lower rate. That was between Boston and New York, where competition might perhaps have been anticipated from Boston-Maine Airways or some allied group.

Newcomers scarce

The failure of Boston-Maine Airways or any other National Airways system company to make any bid whatever was indeed a part of one of the major surprises of the opening. Another part of the same surprise was the total failure of Walter Varney to appear. It was in fact plain that very few of the operators not hitherto carrying mail, and still fewer of the newly-born transport companies of which there had been so much gossip in the past few weeks felt disposed to go after three-month contracts for the sake of getting themselves established in the mail-carrying business. Of the 45 bids received, just over half came from successor companies of previous air mail operators, and from this group came 11 out of 17, or almost exactly two-thirds, of the low bidders.

As a general rule, there was no competition on the routes on which multi-engined equipment was required. They seemed destined to go back to the old contractors by default. It was in the flying through the Mississippi Valley, where the independent operators of airlines have been most persistent in the past and where relatively favorable terrain led the Post Office to allow single-engined planes throughout, that the contest grew hot.

Another surprise was that the old mail carriers (with only a single exception and that one of the operators with least mileage) accepted the Post Office decree in letter and in spirit and reorganized with officials who had had no part in the affairs of the companies in 1930 to submit their bids. Certainly it had been common supposition that at the very least some of the companies would submit alternative bids, one in the name of a potential successor company, with new officials and the other somewhat lower in the name either of the original company or of an alternative successor with the old officials, accompanying both bids with the required affidavit that the officials concerned had been innocent of any violation of law. It seemed a likely theory of action but as a matter of fact nothing of the sort happened.

The crowd dispersed. The bidders went back to their hotels to await an invitation, which might or might not come, to reappear and explain and justify the terms of their offers. The committee of Post Office and Commerce officials sat down around the long table to study the bids one by one with reference to their admissibility and to the rigor with which they had met the specifications. The desire not only that everything should be strictly legal, but that it should all be regarded as perfectly open and above-board and free from the slightest taint was manifest and Mr Branch and other officials answered without objection all manner of questions and were willing to delay the proceedings as long as necessary in order that every inquirer might be satisfied. With the completion of the examination the bids were made public records, available for inspection, and to that we owe the ability to collect the data on the equipment of the various bidders on the opposite page. Three bids which had come in a form deviating in some particular from that specified by the Department or otherwise irregular (the irregularity in one case extending only to the bidder's having used the wrong one of two official envelopes sent him) were carefully considered and whispered over by the legal talent. As it turned out, that made no difference, for none of them was anywhere near being low for their routes.

EQUIPMENT OF BIDDERS

Former mail carriers are omitted from this listing. Their equipment is generally well known and is in some cases too extended and varied for easy and comprehensive listing. Except where otherwise specified, all planes are single-engined.

BOWEN AIRLINES, 4 Lockheed Vegas, 1 Bellanca Pacemaker.

BRANIFF AIRWAYS, 8 Lockheed Vegas.

CENTRAL AIRLINES, 5 Stinsons, 4 Lockheed Vegas.

ALFRED FRANK, 4 Ford Tri-motors, 2 Boeings (40 B4, 4-passenger), 4 Fokker Universals.

HANFORD TRI-STATE AIRLINES, 2 Fords, 4 Lockheed Vegas, 1 Sikorsky (Twin-engine), 2 Stearmans.

LONG & HARMAN, 5 Stinson Reliants, 1 Travelair Monoplane.

MIDWEST AIRWAYS CORPORATION, 7 Flamingos.

MUNCIE AVIATION CORPORATION, 6 Cabin Wacos, 1 Waco F2.

NATIONAL AIRLINE TAXI SYSTEM, 1 Travelair monoplane (S6000B), 1 Ryan monoplane, 1 Butler Blackhawk, 1 Stinson (SM2AB).

PACIFIC SEABOARD AIR LINES, 5 Bellanca Pacemakers, 1 Pitcairn biplane.

ROBERTSON AIRPLANE SERVICE COMPANY, 5 Ryan monoplanes, 2 Travelair monoplanes.

ST LOUIS FLYING SERVICE, 1 Stinson 3 Fairchild 24s (new cabin monoplanes), 1 Lockheed Vega.

SYRA AVIATION CORPORATION, 8 Stinson Reliants.

WEDELL WILLIAMS AIR SERVICE CORPORATION, 4 Lockheed Vegas, 1 Ryan monoplane.

WYOMING AIR SERVICE, 4 Stinsons. Proposes to purchase if contract awarded, 2 Stinson Reliants, 2 Beechcrafts.

NORTHERN AIR TRANSPORT COMPANY INC., 2 Stinsons (T), 3 Stinsons (SM613), 1 Ryan (B-1).

Past and Future Payments

EXAMINING the bids, it is plain that there were two policies ruling among those who prepared them. One group, of which the General Aviation lines (TWA, Eastern Air, and General Air formerly Western Air Express) were the best examples, were determined to get the contracts at any price for this temporary period and so bid figures far below past practice and far below what would ordinarily be thought necessary to break even against the cost attendant on the quality of service that air-mail operators have in the past furnished. Presumably the motive was a determination to stay in the dominant position in the field even at the expense of accepting a substantial loss over a period of a few months in the expectation of later adjustment of rates to a pound-mile basis by permanent legislation or by action of a commission. The other group, represented by United Airlines (for which the policy worked nicely) and American Airlines and Northwest Airlines (for which it worked less satisfactorily), made bids high enough to cover the cost of operation and to represent what seemed a fair business figure for handling the mail with accepted standards of service. Then let the chips fall where they might, taking no business at all rather than taking it at a loss. In the outstanding case of the transcontinental route from New York to San Francisco via Chicago the low bid of United Airlines was actually 2.7 cents higher than the average of 35.3 cents per mile at which the carrying of mail on that route was remunerated in the last half of 1933.

Obviously the last half of '33 had served as a guide in the preparation of many bids. That was particularly apparent in the case of American Airways. Most of that company's routes had during the last six months of the past year been bringing in just a shade under 40 cents a mile, and the successor company bid 39½ on every route except for Boston-New York. There the average rate of return during the last half of the year was 32.9 cents per mile and the bid was 33.3.

The general indication is that the newly organized air-mail map and the new schedules can be operated at a total Post Office outlay of about $7,100,000 per year as against from $14,000,000 up in the past but the aggregate amount of flying likely to be done on domestic routes with air mail will be only about 23,000,000 miles per year as against 37,900,000 miles in 1933. These figures take no account of additional routes which may be covered by later openings.

Meanwhile as knives slit envelopes and exploring fingers drew bids forth for examination in the old brownstone building on Pennsylvania Avenue, legislators on Capitol Hill struggled with revisions of air mail legislative projects to get a law that would give a fair and workable basis of operation through a transitional period while deliberate and all-inclusive study was developing a permanent national air policy, and that would provide for the creation of the commission that the President had desired to be set up to make such a study. The problem is full of troublesome knots to be unraveled, but upon the whole the omens were at the hour of going to press with AVIATION, good.

BIDS AND BIDDERS

Openings of April 20 and April 27. The April 20 openings are marked with asterisks.

Route	Bid (cents)	Bidder
NEW YORK—CHICAGO—SAN FRANCISCO	36	United Air Lines, Inc.
NEW YORK—KANSAS CITY—LOS ANGELES	24	TWA, Inc.
	39	American Air Lines, Inc.
CHICAGO—ATLANTA—JACKSONVILLE	19	Eastern Air Lines, Inc.
	35	Braniff Airways, Inc.
	39	American Air Lines, Inc.
BOSTON—CLEVELAND—FORT WORTH	29	Syra Aviation Corp.
	39	American Air Lines, Inc.
	40	Braniff Airways, Inc.
NEW YORK—MIAMI	29	Eastern Air Lines, Inc.
NEW YORK—ATLANTA—NEW ORLEANS	19	Eastern Air Lines, Inc.
	39*	American Air Lines, Inc.
CHICAGO—NEW ORLEANS	17½	Pacific Seaboard Air Lines, Inc.
	24	St. Louis Flying Service, Inc.
	28	Robertson Airplane Service Co.
	30	Wedell-Williams Air Service, Inc.
	39	Braniff Airways, Inc.
	30	Muncie Aviation Corp.
	39½	American Air Lines, Inc.
CHICAGO—DALLAS	22½	Braniff Airways, Inc.
	39½	United Air Lines, Inc.
	39.94	Mid-West Airways Corp.
SEATTLE—SAN DIEGO	39	United Air Lines, Inc.
AMARILLO—SAN ANTONIO—BROWNSVILLE	19½	Long & Harman Inc.
	29	Braniff Airways Inc.
	31½	Bowen Air Lines, Inc.
	39½	American Air Lines, Inc.
CHICAGO—TWIN CITIES—PEMBINA	19.6	Hanford's Tri-State Air Lines, Inc.
	24½	National Air Line Taxi System
	39	Northwest Air Lines, Inc.
BOSTON—NEW YORK	33½	American Air Lines, Inc.
WASHINGTON—PITTSBURGH—DETROIT	33.8	Central Air Lines Inc.
	28	Pennsylvania Air Lines & Transport
	39	American Air Lines, Inc.
CHEYENNE—DENVER—PUEBLO	45	Wyoming Air Service Inc.
	39	General Air Lines
SALT LAKE CITY—GREAT FALLS	38	Alfred Frank
SALT LAKE CITY—SEATTLE	39	United Air Lines
SALT LAKE CITY—LOS ANGELES—SAN DIEGO	24	General Air Lines
*DETROIT—MILWAUKEE	33	Alfred Frank
	46	Kohler Aviation Corp.
*FORT WORTH—LOS ANGELES	39½	American Air Lines, Inc.
*NEWARK—BUFFALO—CHICAGO	39½	American Air Lines, Inc.
*FARGO—SEATTLE	38.8	Northern Air Transportation Co.
	33½	Northwest Air Lines, Inc.

The third article of a series on the definition and control of cruising conditions

Performance Testing and Engine Power

By Edmund T Allen and W. Bailey Oswald

CONVENTIONAL performance testing of an airplane consists essentially of the accurate determination of two sets of maxima, maximum climb-rate and maximum level velocity at all altitudes within the airplane's range. Aside from the technical difficulties inherent in measuring true maximum values with the required precision, a further obstacle arises in the constantly shifting properties of the earth's atmosphere. Fortunately we are able to make our tests on non-standard days and convert results to those theoretically obtainable under standard conditions, a process called correcting or "reducing" flight test data.

Unfortunately all testing agencies are not agreed upon the correct method of "correction." Results obtained, for instance, at the Army Air Corps testing section are not strictly comparable with those issuing from the Naval testing personnel, or those of the National Advisory Committee for Aeronautics. The Army believes in a Density Standard and "reduces" all its performance to the ideal density atmosphere. The Navy believes in a Pressure Standard for velocity and a partial-pressure, partial density standard for climb. It is thus necessary for the private testing agency to "reduce" the flight test data two ways.

Assuming that flight test data have been measured with great accuracy and corrected in the manner determined to be the most scientific, the question still remains as to what we have really found out after all this trouble, for ordinarily little is known concerning the power output of the engine during the test. We have measured speed with an observational and flight-technique precision of possibly ¼ of a per cent, we have modified our observed readings by applying a correction to standard seldom exceeding 1½ per cent, but by terminating our corrections without taking into account weight and power variations we neglect an error which may amount to 5 or 6 per cent. An analogous situation exists in the reduction of observed data on climb.

This situation has by no means escaped alert testing agencies. For the private manufacturer whose interest in accuracy is greater than the desire for a questionably high maximum performance, an effort is made to limit power-output to the rating of the engine at its critical altitude. This is not a simple process since it involves many variables. The Department of Commerce has placed a limit upon engine-revolutions. It requires that the propeller be of such pitch that the engine manufacturer's rating of revolutions is not exceeded. For non-controllable-pitch propellers the Department allows 5 per cent over the rated revolutions in high speed level flight at critical altitudes so that takeoff will not be too seriously penalized by lack of power. With controllables, however, where nearly full power is available in low pitch on takeoff, the excess revolutions are not allowed. Recently the Department of Commerce has placed a limit also upon Mean Effective Pressure in the form of a maximum allowable value for intake manifold pressure. Neither of these limitations, —r.p.m. or manifold pressure—determine power, and power, therefore, is the uncertain factor.

It is possible to determine high speed accurately, but such a determination involves careful power determination and reduction to standard atmospheric and airplane conditions as well as careful flying technique. The maximum velocity at specified rated power, correct gross weight, and standard atmospheric conditions can be obtained by correcting the observed maximum velocity to standard maximum velocity. An extended analysis of the data indicates that none of the measurements effecting engine power, atmospheric or airplane conditions may be ignored without introducing errors into the result. Neglect of the effect of gross weight introduces an error which may reach a magnitude of 2 per cent; neglect of the effect of temperature introduces an error which may amount to 1½ per cent; neglect of the effect of variation in power may cause a variation of as much as 4 per cent in velocity determination. The general airplane characteristics determine the degree in which each of these often-neglected variables influences high speed.

Obtaining full-rated power at rated engine-revolutions and correct manifold pressure is one of the first problems of a flight test program. Carburetor air temperature and manifold pressure can be modified or corrected for in flight at critical altitude. When this correction has been made and the additional corrections for weight and density computed, the first point can be obtained for a performance graph. Often, however, velocity determination ends as well as begins here. In such cases there will be obtained but one point on a performance graph which, if completely explored, might yield surprising economies. One such point is of no real significance for transport flying, private flying, or 99 per cent of military flying. This is illustrated graphically, by point 1 on Fig. 4, viz; 100 per cent of rated power at rated altitude. For all normal flying we are not able to enter the forbidden territory (the lighter shading on the chart of Fig. 4) above 75 per cent power. Occasionally, where flight testing has gone in for the fine points, usually limited to the theorist but now coming to have major significance for the pilot also, power-output is assumed to follow the curves of Fig. 4 with altitude for purposes of flight performance. Lack of caution in interpretation may lead to serious errors, however, since it must always be borne in mind that the power-output of these curves applies only to full throttle level flight in standard atmosphere where standard temperatures prevail in the engine intake air duct. The curves are also to be regarded as averages for the general type of American engines of the clutchless supercharged blower-induction-system type.

Referring again to Fig. 4 we see that the more heavily shaded area under the full-throttle curve and to the left of the cruising-power ordinate is the operating area, and in this area the conventional flight test has disclosed virtually no information. Assuming the correctness of the curves and their application to the engine under test, and assuming also that all the corrections have been made to reduce it to conformity with actual conditions we shall have point 2 determined, namely, the altitude at which full-throttle at rated revolutions will give us just 75 per cent power in level flight at standard temperature. This point is, however, not usable on a transport line for cruising because, unless propellers are reset, engine revolutions are too high.

Point 3 (cruising power at cruising revolutions at "optimum cruising altitude") is as yet indeterminate unless we use the misleading cube rule which will be explained presently. In order to obtain this ideal combination of cruising conditions it would be necessary (1) to reset the propeller pitch to hold cruising revolutions at full throttle at the proper altitude where cruising power would be maintained and (2) to have a means of power determination in flight. The heavy dashed curve marked "normal full throttle output for constant propeller pitch setting" illustrates the difference between the variation in power-output with altitude along a constant propeller-pitch line and along constant rp.m. lines (obtainable in full-throttle level flight only by means of infinitely controllable propeller pitch or automatic pitch changing to hold constant revolutions). This constant pitch line will pass through point 3 and below point 1 when the pitch has been set to hold cruising revolutions at optimum cruising altitude. Fig. 4 is of little use

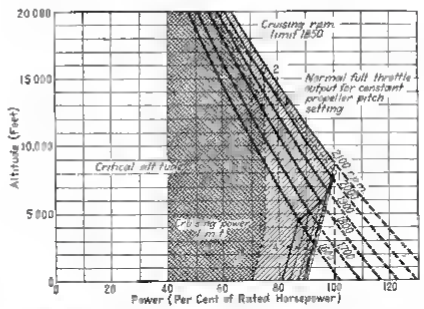


Fig. 4: Full throttle horsepower vs altitude for various engine revolutions, showing cruising areas and emergency areas of power output. Curves are for full throttle, and are obtainable only by resetting propeller pitch. Point 1 is 100 per cent of rated power and is obtained at critical (rated) altitude and at rated engine revolutions. Point 2 is at 75 per cent of rated power at full throttle with propeller pitch set to allow full rated revolutions at this altitude. Point 3 is at 75 per cent of rated power at full throttle at cruising revolutions, and is obtained by resetting propeller to hold these revolutions at full throttle at this altitude. Point 4 These lines represent the engine manufacturers' limitations for low altitude maximum allowable power and cruising power. These lines are based on constant manifold pressure for this engine.

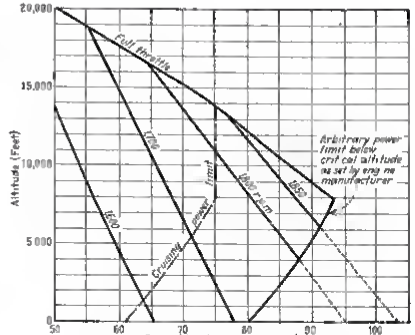


Fig. 5: Power vs altitude for full throttle and various throttled engine revolutions for constant propeller pitch setting. Cruising power is limited by engine manufacturers to constant manifold pressure at low altitude.

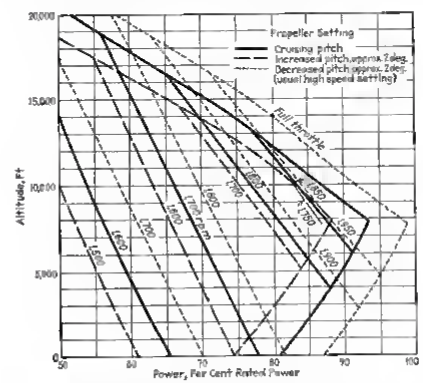


Fig. 6: Per cent power vs altitude for various engine revolutions showing dependence of power upon propeller pitch setting. High power can be taken out at low revolutions with high propeller pitch setting.

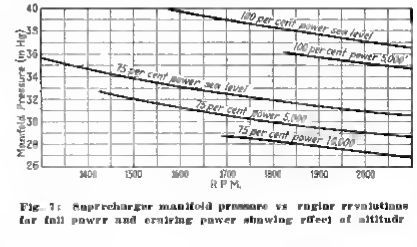


Fig. 7: Supercharger manifold pressure vs engine revolutions for full power and cruising power showing effect of altitude.

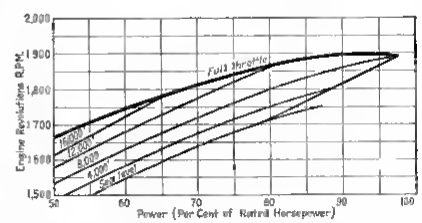


Fig. 8: Engine revolutions vs. power output for various altitudes showing full throttle variation of power with revolutions.

to the pilot because he cannot as yet control independently his engine revolutions, power and altitude. It is useful to us here in clarifying the conception of "throttling" the engine with altitude by means of the decreasing density as we ascend. It aids also in demonstrating the effect of engine revolutions upon full throttle power at altitudes.

Cruising defines a set of conditions for which altitude (and also temperature) are completely upsetting factors if they are not taken into account. It is as impossible to cruise safely or efficiently with throttle setting as a guide as it is to fly normally at the cruising performance quoted by many testing agencies.

Even at the cruising level, however, specificity is often lacking. Cruising has been seriously defined as "a slightly throttled condition." Performance tests, both of military and commercial airplanes, usually do not include actual determination of climb or speed at cruising power. "Cruising" speed has been taken as a certain percentage of maximum speed without regard to whether this speed could be maintained indefinitely on an airline, for instance, without exceeding the airline's criteria for engine maintenance costs and engine reliability.

The testing of speed at cruising power has become of importance recently as specifications on this element of performance have been written into contracts for new aircraft. A criterion for cruising power is lacking, however, because no satisfactory thrust and torque meter is available for use in flight. Transport operators are inclined to favor a certain "cruising revolutions" as the determining factor. Lacking something better, 1,700 r.p.m. has long been considered the guide to cruising even when the operator had no idea how much power-output he desired to specify. Even with rated engine speeds increasing to the 2,500 r.p.m. level, some operators have been reluctant to leave the 1,700 r.p.m. tradition for cruising although they obviously wished to use 75 per cent power.

Figs. 5 and 6 illustrate how it is possible to obtain very nearly full power at "cruising revolutions" if this limitation only is used as a guide to cruising operations. In Fig. 5 percentage of rated power has been plotted as abscissa versus altitude as ordinate for various engine revolutions in level flight, illustrating how rapidly power drops off at high altitudes at constant engine-speed. In this figure the propeller is set for optimum cruising condition at 14,000 ft. If 1,700 r.p.m. is the blanket cruising limit set by the transport operator he will be taking out 78 per cent power at sea level and far exceeding the engine manufacturer's cruising recommendation for low altitude, while at high altitude he will limit the cruising performance of the airplane to a point absurdly far below the recommendation of the engine manufacturer. If, on the other hand, it is desired to cruise always at 75 per cent power, this would involve using 1,680 r.p.m. at sea level, 1,750 at 8,000 ft. and 1,850 at 14,000 ft. As can be seen from Fig. 3 (AVIATION, April, 1934) cruising at 75 per cent power is not permitted. For all conditions at low altitudes the manifold pressure cruising limitation holds controllable power output below 75 per cent; at medium altitudes the cruising power limitation holds and limits both manifold pressure and engine revolutions below their specific cruising limits; at higher altitudes the engine r.p.m. cruising limit becomes predominate if the propeller pitch has been set to permit more than cruising revolutions at optimum cruising altitude.

Fig. 6 illustrates in addition the effect of changed propeller pitch setting on engine power in level flight. Power developed in flight is directly dependent upon propeller pitch setting.

The cube rule

Some of the military aircraft testing agencies have adopted a rule for the determination of cruising speeds based upon the empirical formula that power on the propeller load curve is proportional to the cube of the engine-revolutions. Thus if the propeller pitch is adjusted to allow full rated engine-revolutions at full throttle at critical altitude in level flight, it is assumed that 75 per cent power is obtained at 91 per cent of those rated revolutions in level flight at this same altitude. This empirical method of cruising-power determination has been adopted for want of a more satisfactory method by some transport lines and some aircraft factories. It is open to serious objections.

The principal difficulty with the cube rule for cruising-power determination is that it is based on an erroneous, or at best uncertain, full-power assumption. It is rarely possible, or advisable, to obtain exactly full rated brake horsepower at critical altitude at the maximum level speed of the airplane. Usually the power-output is less than rated power owing to (1) too high propeller pitch, (2) insufficient ramming intake, (3) too much preheating of the intake air, (4) or some malfunctioning of the engine. If for any of these reasons the power-output at full throttle in level flight at critical altitude is not exactly rated engine power, then cruising speed determined from the cube rule will be determined for a cruising percentage of this erroneous power rather than for the cruising percentage of the rated power.

One must, indeed, be very careful in accepting cruising performances based on the cube rule because of the possibility of obtaining fictitiously high 75 per cent power cruising speeds at 91 per cent of the rated engine revolutions by setting the propeller pitch up to take much more than 75 per cent power out of the engine at these revolutions as illustrated by Fig. 6. The engine will not then turn its full rated revolutions at full throttle without resetting the propeller pitch but this fact often escapes the unwary buyer.

Another serious error appears in the cube rule when applying it to altitude cruising performance. If the same engine revolutions are used as a basis for the computation at high altitudes that were used at rated altitude the cruising power will of course drop off rapidly from the desired value as shown in Fig. 5. Thus, when one thinks one is cruising at 75 per cent power one may have but 52 per cent of rated power available at these revolutions at this altitude. If, on the other hand the airplane is flown at full throttle at the cruising altitude desired, and the revolutions so determined used as a basis for finding cruising revolutions, the error is even greater because full-throttle revolutions and full-throttle power drop off with altitude as shown in Fig. 4 (constant pitch curve). It is thus always necessary to determine (1) the full power at whatever altitudes cruising speed is to be specified, (2) the conditions under which this full power is obtained (3) that all these conditions have been met or corrected for, and (4) that none of the conditions are altered while cruising speed is determined. Even when this is done the questionable basic assumption of the cube rule remains. Formerly the arbitrary engine revolution limit was specified, such as 1,700 r.p.m. regardless of altitude, intake manifold pressure, propeller pitch, or air temperature. Fig. 5 shows how far such a ruling missed cruising power control, permitting excessive power output at low altitudes or ridiculously low performance at high altitudes. Fig. 6 indicates how a change in propeller pitch can dangerously overstress the engine for cruising performance under this dogmatic cruising ruling.

The transport operator's decision with regard to his desired cruising power and altitude will influence the propeller pitch setting as is shown in Fig. 6. If, for instance, the operator desires to cruise normally at 65 per cent power and at approximately 15,000 ft., he will use the propeller pitch shown in the short dotted lines, because with this pitch he can obtain 65 per cent power at 1,660 r.p.m. at sea level and at 1,825 r.p.m. at 15,000 ft. The 1,660 r.p.m. at sea level is preferred by the engine manufacturer over the 1,595 r.p.m. of the original pitch setting because with the higher r.p.m. the desired cruising power is obtained at a lower manifold pressure. At high altitude 1,825 r.p.m. is preferred by the engine manufacturer for 65 per cent power as giving the optimum balance in the engine between centrifugal loads and explosion loads.

Manifold pressures important

The vital importance of manifold pressure as a guide to cruising is beginning to be recognized by the transport operators as a result of the engine manufacturers' insistence upon limiting cruising mean effective pressure. In Fig. 7 there is illustrated the effect of r.p.m. upon manifold pressure at constant power and constant altitude. At 5,000 ft. 75 per cent power is obtained at 32 in. (of mercury) manifold pressure and 1,450 r.p.m., or at 29.5 in. at 1,830 r.p.m. The engine manufacturer would prefer the latter combination because of better distribution of centrifugal and explosion loads in the engine.

Disregard for the effect of altitude on power leads to the error in power determination shown in Figs. 8 and 9, depending upon whether the cube rule as applied for critical altitude is held as a revolution limitation for all altitudes or whether now revolution limitations are determined for every altitude (i.e. cube of rated revolutions or cube of actual revolutions). These figures illustrate the change in revolutions required by changes in altitude for maintaining constant power.

One line issued instructions to pilots to fly at 75 per cent power at 8,000 ft., giving the engine revolutions necessary to obtain this cruising condition. After a month of increased percentage of engine failures and high operating costs it was discovered that when weather conditions prevented cruising at 8,000 ft. altitude, as they often did, the pilots cruised at low altitudes at this same figure for engine-revolutions, not realizing that power-output was as high as 87 per cent for these conditions instead of the desired 75 per cent.

At the other end of the performance range the issuance of arbitrary revolution limits definitely prevents the realization of either optimum speed for a given percentage cruising power, or optimum economy or range for the maximum cruising power. This can be graphically illustrated in plotting velocity versus altitude for various cruising percentages of rated power and engine revolutions. Fig. 10 and 11 show this relationship for the usual range of cruising engine-revolutions and percentages of rated power-output. Comparison of these figures shows the marked differences of the variation of speed at altitude with power and engine-revolutions.

In the airline instance mentioned above, the operations personnel had, shortly before the uncontrolled power incident, increased their official cruising engine-revolutions from 1,700 to 1,900 r.p.m. There was virtually no decrease in engine reliability following this change. When, however the "over-supercharging" occurred at constant r.p.m., the loss in reliability was marked. This illustration clinches again the point repeatedly made above, that when we can free ourselves from our prejudice against increasing cruising engine-revolutions and realize the danger of increasing intake manifold pressure as well as excessive revolutions, we shall have made a real advance toward intelligent control of cruising power.

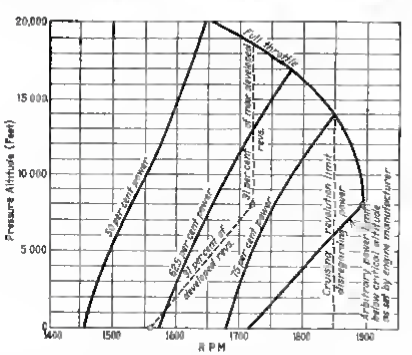


Fig. 9: Engine revolutions vs. altitude for various percentages of rated power in level flight. Propeller has been set for optimum cruising condition. Effect of cruising by the cube rule based on maximum developed revolutions is shown. Cruising at normal revolutions (1,832) below critical altitude is dangerous because of excessive power.

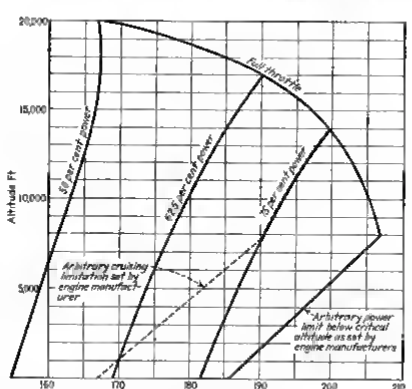


Fig. 10: Velocity vs. altitude for level flight at full throttle and various percentages of rated engine power showing increase in velocity at constant power by increase in altitude. Constant propeller pitch setting for optimum cruising conditions.

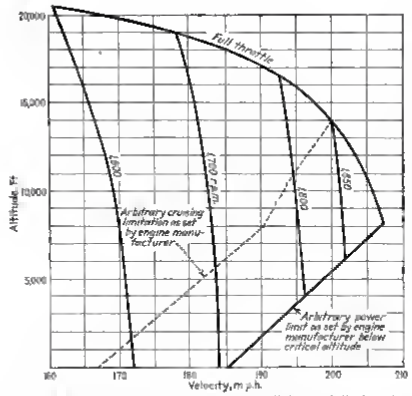
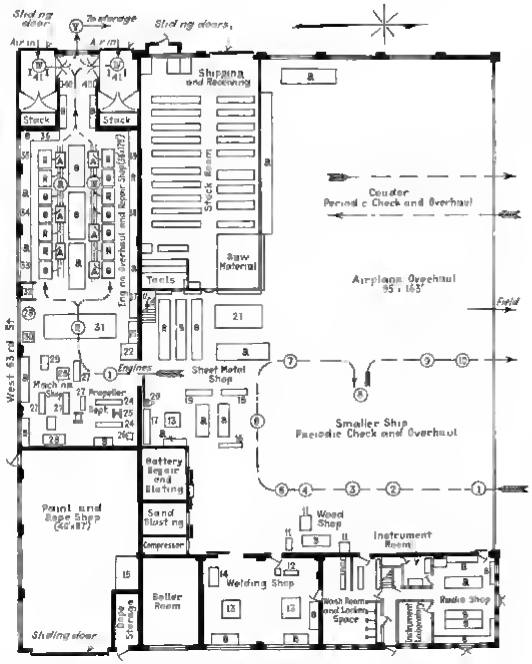


Fig. 11: Velocity vs. altitude for level flight at full throttle and various engine revolutions with constant propeller pitch set for optimum cruising conditions. This graph illustrates the decrease in velocity with altitude at constant revolutions in contrast to the increase in velocity with altitude at constant power.

American Airways inaugurates a modern repair and overhaul plant at Chicago

Under the White Eagle

By S. Paul Johnston
Associate Editor



American Airways' Chicago base in plan on the second floor of the section along the eastern end were the welding and radio shops. Shop offices are over main stockroom

The general operating offices are housed

Airplane Overhaul Routine I Receive, inspect and weigh in II Disassemble III Wash and clean IV Repair wood fairings, floors, etc. V Weld structure landing gear etc. VI Repair and refit sheet metal parts, cowling etc. VII Cover fabric surfaces, reupholster etc. VIII Remove parts to dope and paint shop IX Reassemble X Inspect and weigh out

Engine Overhaul Routine I Tear down and clean II Inspect III Repair parts and reassemble IV Run in and test, V Final clean up

Equipment 1 Engine assembly stands 2 Benches 3 Engine parts racks 11 Woodworking equipment 12 Drill and hydraulic press 13 Welding tables 14 Heat treating furnace and quench tank 15 Paint spray booth 16 Sheet former roll 17 10 ft. brake 18 Brake 19 Shear 20 Trip hammer 21 Upholstery work table 22 Cleaning spray booth 23 Cleaning dip tanks 24 Propeller pitch table and protractor 26 Propeller balancing stand 28 Portable sawhorse 27 Lathes 28 Grinders 29 Shaper 30 Drill 31 Inspection table, 32 Superintendent's desk 33 Generator and dynamotor overhaul 34 Magneto overhaul 35 Carburetor overhaul 36 Starter overhaul 37 Cleaning grinding and buffing 38 Spark plug overhaul 39 Ignition harness overhaul 43 Tool stand control 41 Engine test stands

AT A TIME when the aeronautical industry is experiencing the worst weather in its history, with showers of dead cats and low hanging political fogs reducing operating conditions to practically zero-zero, considerable encouragement can be derived from reviewing the great technical advances which have taken place during the last year or so, not only in the design of aircraft but also in general improvement in efficiency and economy in the maintenance and servicing facilities on the ground No one who has followed our study of maintenance shops over the past two years can fail to be aware of the tremendous progress which has been made by the airlines in these particular departments A trip through one or two of the magnificent plants which have sprung up at strategic points for the purpose of keeping aircraft fit to fly, might prove to be a most educational experience for those who sit in Washington to pass judgment on a great and growing industry

The need to concentrate

One of the latest units to join the ranks of outstanding maintenance plants in this country is the new American Airways repair base and overhaul shops at the Municipal Airport at Chicago As its present system evolved, it found itself possessed of a number of servicing and overhaul shops scattered fairly well across the country In addition to terminal servicing shops such as those at Los Angeles, Atlanta, Newark and Detroit, both engine and airplane overhaul units were in operation at Dallas (AVIATION, November, 1932), St Louis, Cleveland, Pontiac (AVIATION, December, 1932) and Chicago Such a diversification of effort being obviously inefficient, plans were laid during the early part of 1933 to concentrate all work in two modern and highly efficient shops Operations in the Southwest were moved from Love Field, Dallas to a new shop and hangar at Fort Worth, and all other overhaul equipment was centered at a new plant in Chicago The Fort Worth plant handles all equipment between Atlanta and Los Angeles, as well as the planes and engines operating into New Orleans and Brownsville, Texas Everything else passes through the Chicago shops for repair and overhaul Servicing stations are, of course, maintained at all terminal and other strategic points in the system John L. Ruden has charge of maintenance for the Eastern division H D Ingalls is general superintendent of base repair depots for the system with headquarters at Chicago William B Click has charge of maintenance and overhaul for Southern division with headquarters at Fort Worth The Chicago repair base is directly responsible for co-ordination of problems of the two divisons in furthering standardization and effecting modifications and engineering changes, and making recommendations to the various manufacturers.

Although all American Airways operations are located on the Chicago Municipal Airport, the division between the operating and servicing elements and the overhaul functions are clear and distinct Operations offices and line servicing are in the old Century Airline hangar in the corner of the field immediately adjacent to the passenger terminal Here all ships coming and going receive routine day-to-day grooming Ships are fueled oiled cleaned and inspected radio sets are checked minor maintenance repairs are made, and storage batteries kept on charge All this sort of work is done in very close connection with general operations, the radio, meteorological and dispatching people being located in offices immediately adjacent to the servicing hangar When the time comes for major check and repair or overhaul of airplane, or engine change and overhaul, or any repair over and above those which come under the head of line servicing, ships are pulled out of active service and shunted down to the overhaul shops some several hundred yards west where they pass into the hands of Dick Ingalls and his crews

Little need be said here on the physical layout of the plant and its several departments, the accompanying plan view and the several photographs of various corners of the shop give a good, general impression of the plant By making a careful selection of the equipment available at the St. Louis and Pontiac shops, and by careful study of floor space and methods of routing, a very efficient layout has been achieved

Airplane overhaul

The planes coming into the Chicago base consist chiefly of Curtiss-Wright Condors Stinson Airliners (both Models "T" and "U"), American Airplane Pilgrims, Ford Trimotors and Stearman single engine mail planes The airplanes are brought in at regular intervals for (1) overhaul (2) 350 hour check and repairs (3) engine change (4) urgent repairs and (5) engineering changes Definite sections of the hangar floor are allocated to these operations The western end of the shop is reserved for 350-hour checks, engine changes and repairs and is equipped with numerous portable racks and tables available to facilitate accomplishment of work without moving the airplanes

Airplane overhaul Looking west through the main shop In the background is Curtiss-Wright Condor receiving final touches after overhaul The Stinson tri motor in the foreground is in one of the intermediate stages on the progressive overhaul line One corner of the stockroom and the sheet metal shop are visible in the left

Looking upstream in the engine shop Engines up to about 500 hp.—Lycomings Whirlwinds etc.—come down the left-hand assembly line The larger Cyclones Hurricanes and Wasps move down the right hand line The propellor overhaul and the machine shop are visible in the background

It has been the custom to overhaul airplanes every 2,500 to 3,000 hours, but the present plan of the company is to replace the older equipment with faster airplanes; for this reason there are no airplanes being overhauled at this time and the entire shop is being used for 350-hour checks, repairs and engine changes. When in the process of overhaul, however, the airplanes are moved from station to station throughout the shop for the various operations. Their general progress is noted in the shop layout plan. It should be observed that the various sections of the shop devoted to woodworking, welding, sheet metal work, fabric work (including upholstery), etc., are located immediately adjacent to the particular operation which they serve.

The airplane shop is fitted up with a full complement of portable work benches, racks, painting units, etc. Vapor-proof drop lights are used as a precaution against fire. Engines are handled by means of chain-falls suspended from overhead rails and also by means of a Lewis-Shepard master stacker (3,000-lb. capacity, hand operated). The latter is mounted on wheels and is readily portable to all parts of the shop, so that engines may be installed or removed from planes independent of their position with respect to the overhead trolley system. This device is particularly useful in the end of the shop where planes are moved from station to station. Electric power and compressed air are made available all over the shop from portable manifold boxes. Grounding terminals are also scattered about at frequent intervals over the concrete floor, so that connections from airplanes may be conveniently made regardless of their location in the shop. Among numerous items of small equipment available for use on both incoming and outgoing ships, is a large portable vacuum cleaning unit made by the Spencer Turbine Company of Hartford, Conn.

Engine overhaul

All functions relating to engine overhaul, with the exception of the welding up of exhaust manifolds are housed in the lean-to which runs along the back of the main overhaul hangar. Propeller overhaul and the general machine shop occupy the extreme eastern end. Incoming engines progress in an orderly fashion from one end of the shop to the other. They are first disassembled, washed and inspected after which the parts are all put on portable racks and start down through the shop along the assembly line. One assembly line takes care of the larger engines of the Wright Cyclone and Pratt & Whitney Hornet class and the other, the smaller engines: Lycomings, Whirlwinds, etc. Another crew overhauls the dynamotors, control boxes, generators, starters, carburetors, magnetos and other engine accessories. All engines in American Airways service are pulled for overhaul at the end of 350 hour periods of flying service with the exception of Lycomings which are overhauled at 400 hour periods. The labor required for complete overhaul varies on the different type engines ranging from approximately 60 to 120 hours depending on the type. These figures include run-in time and overhaul of engine accessories. The shop operates on the crew overhaul plan and has a potential capacity of some two to four engines per day, although current demands do not require operation at maximum rates.

It will be noted that the engine run-in stands are built into the shop proper. The walls, doors and windows surrounding the test stands have had to be very carefully insulated against sound to prevent an uncomfortable noise level in the shop. An ingenious arrangement of doors and air ducts makes it possible to maintain any desired temperature condition or degree of air flow in the test houses. During set-up on test stands the outside doors can be closed and the room steamheated so that working conditions are comfortable, and the engine can be started easily. When tests are run, the inside doors are closed the outer doors open as much as necessary to give the desired volume of air flow and the doors connected to the vertical stacks (or flumes) are also open. Air is drawn into the test room from ground level and discharged through the large stacks projecting through the roof.

Spark plugs, ignition harness

Although there are many features of the engine shop which are worthy of mention, perhaps the most interesting is the method of handling ignition harnesses and spark plugs. It is American Airways practice to make up their own ignition harnesses using shielded ignition cable. The only housing of any kind is an aluminum manifold around the base of the cylinders. The shielded cable protrudes through holes in the conduit to the spark plugs, and also to the magneto distributor blocks. A very simple and effective brass ferrule is applied at both the magneto and spark plug end of each cable. The ferrules not only provide a good mechanical terminal, but also take care of completing the shielding by connecting the braid around the cable through suitable terminal housings or to the spark plug caps.

The majority of spark plugs used are Hurley-Townsend radio shielded. A very interesting method of salvaging and reconditioning plugs has been worked out. As a general rule, plugs are kept in an engine for one half the period between an overhaul. It is usually necessary to remove only the front plugs in any cylinder at intermediate inspections unless operating reports indicate that definite trouble can be traced to the plugs. New plugs start operation with an electrode diameter of 0.210 in. and a clearance of 0.015 in. When it is found that clearances have increased to the allowable maximum which is reached at 150 to 200 hours service, plugs are removed from the engines and disassembled, and the electrodes are chucked in a lathe and reduced to a diameter of 0.190 in. At the same time, the shells are all sent to the welding shop where the bore is completely welded over, using H-T electrode welding rod. The shells then go back to the machine shop and are put through an automatic screw machine which redrills and reams the bores to give the original 0.015 clearance around the 0.190 electrodes. They are then reassembled and put back into service for another period. The plugs are put through three overhaul cycles of this sort in which the diameter of the center electrode is reduced by steps from .210 to .190 to .170 to .150 in. After they come back to the shop for the fourth time, the electrode diameter is considered too small. The plug cores are not discarded at this time, but are reconditioned by welding on a new electrode. Ordinarily, all engines are changed at Chicago and the plugs are put directly into the shop. Whenever it is necessary to change a set at any outlying stop, they are sent back to the Chicago base for reconditioning. The various parts of the plugs pass in succession through the welding and the machine shops, finally to the ignition department where they are assembled and tested. CO_2 pressure up to 200 lb. is now used for testing. The present cost for the reconditioning outlined above approximates 14 cents per plug per overhaul.

Instruments and radios

The usual practice of putting all instruments and radio equipment in the shop for complete overhaul at about engine overhaul period is followed by American Airways. Of course, if any trouble develops in any unit at intermediate periods it is immediately replaced and sent in for inspection. Complete facilities are available in the northern end of the office wing for rebuilding of all types of navigational and engine instruments including those of the gyroscopic variety. In an adjoining room, a crew of radio mechanics labors constantly to keep the communication facilities of American Airways up to the highest possible degree of operating efficiency.

In establishing a new overhaul base at Chicago American Airways offers another example of the trends in modern airline operation to concentrate as much as possible all the maintenance functions approximately in the center of the zone of operation. As a general rule it is considered good practice to operate so that no piece of equipment is more than one day's flight away from its base.

Forgotten Fliers

The fixed-base operator has his day in Congress

UPON Capitol Hill in Washington air transport is a familiar subject, and never more familiar than during the past three months. Aircraft manufacture has an accustomed ring in the ears of Congressmen who have received proposals for five-year programs and the like and have referred them to committee and debated them to and fro ever since 'way back before the War. But there is another large group in aviation from which but little has been heard and of which little has been said in the seats of government. The fixed-base operator's base has been so very fixed, as a general rule, that he has never left it to journey to Washington.

But the last few weeks have changed all that. The operator of flying service and of the small privately-controlled airport has created his own trade association, and through it he has become vocal. The Independent Aviation Operators of the United States recently met in Washington and served notice of the needs of its members. From this newly acquired collective consciousness of a class interest there have come bills introduced in both branches of Congress.

The standard of the fixed-base operator was first planted in a Congressional committee room on March 27, when a subcommittee began hearings on the Sheppard bill (S. 2991) to encourage civil aviation in the United States. The representatives and the champions of the flying service operators who have preserved the pioneer spirit and kept heading forward in the face of all the discouragements of deflation were present to urge upon the Senate committee the importance of legislative assistance to husband the assets of the fixed-base group,—largest group of the aviation industry in point of airplanes owned and operated, and largest also in point of number of individual business units concerned.

Help for schools

The Sheppard bill consists of three sections, possessed of the common purpose to support civil aviation but adopting widely different methods. The first section, a direct subsidy for flight training such as has been given under one guise or another in most European countries and in practically all of the British dominions, authorizes the Secretary of Commerce to pay 25 per cent of the total cost of instruction to any student who might take training in any civil flying school in the United States and secure a Department of Commerce license of the private or higher grade. The number of students to receive such pay would be limited by the bill to 5,000 per year, presumably on a first-come-first-served basis, and the amount to be spent by the government on such subsidies would be held to $1,500,000 per year.

An allowance of $300 per student on a 25 per cent subsidy basis would mean an average tuition fee of $1,200, and manifestly it is the hope of those drafting the legislation that a great many of the newly stimulated students drawn in by the bait of government assistance would take transport courses. The desire to promote military interest in the plan for subsidized instruction and to give the students so trained a maximum value as a military reserve led the framers of the bill to restrict its benefits to applicants between the ages of 18 and 25 years. Perhaps the desire to make sure of catching the subjects out of the truly air-minded younger generation which in course of time may be expected to buy airplanes if it is given enough encouragement to keep on with its air-mindedness may also have had something to do with that. Were the bill to be accepted as drawn, of course a certain amount of the subsidy would go to lighten the financial burden on students who would have taken courses in any event, entirely at their own expense if necessary. Another part, however, would have supplied the final ounces of persuasion for young people hesitating on the brink of taking flying lessons or previously considering themselves definitely unable to do so and would have brought in students that wouldn't have appeared on the schools' rosters at all under any other conditions. The annual expenditure of $1,500,000 by the government ought then to increase the total assets or revenues of the flying schools, and the total amount they can spend for employment and supplies and new aircraft and the like, by at least $2,500,000 and perhaps as much as $3,500,000.

Help for inventors

The second section of the bill of a very different order, was designed to help the unfriended inventor or engineer now suffering from lack of corporate backing or of a benevolent "angel." It authorizes the Secretary of Commerce, subject to such regulations as he may prescribe, to contract with the designers of aircraft, aircraft engines, and aircraft accessories to convert their ideas into full-sized working models. The sky would be the limit on the scope of the authority, and the Secretary might contract for whatever would in his judgment advance aviation, but his payments to the designer or inventor would be limited to the actual cost without profit. The method of determining "cost" is unspecified.

Getting pre-formed kay-dets

The third of the arms that the Sheppard bill reaches out to the rescue of hard-pressed aeronautical groups proposes legal standing for an old idea. Upon many an occasion in the last ten years it has been argued that the Army and Navy would at the same time decrease their own training cost, increase their reserve forces and give an invaluable boost to civil flying if they would provide some recognition for the flight training received in civil schools.

In England in the past, and in France even to the present day, civilian schools have been used for preliminary training and for the refresher practice of reservist pilots. Schemes for using them in that way in America have been more or less well and completely worked out from time to time since the War but the Army and Navy have been persistently chilly to all such proposals. Always the services have insisted upon the desirability of a training under military control from start to finish. No matter how much civilian experience a man had, be he a gypsy flyer with hundreds of hours of nursing a Jenny into and out of tiny fields or a private owner-pilot with hundreds of hours on his own fast and high-powered ships, when he went to Brooks or Randolph Field or Pensacola he was a cadet in a class of cadets, one whose training must be undertaken from the beginning in orderly fashion.

But upon these points the attitude of the Army and Navy and of the civil schools as well have in the past been recorded only through somewhat informal discussions. The Sheppard bill would bring the issue to an official head for its third section provides that

in the appointment of cadets for the flying schools of the Army special preference shall henceforth be given to holders of Department of Commerce pilot licenses, subject of course to Army regulations as to minimum educational and physical requirements

Such was the bill. On March 27, as already recorded, it came to hearing, and as not infrequently happens the forces of the various departments of government lined up on opposite sides

Army and Navy sceptical

Letters from Admiral W. H. Standley, Chief of Naval Operations and by that sign highest ranking officer of the Navy, and from the Secretary of War, indicated that the Army and Navy were not impressed. The high military powers agreed that any funds available for personnel development in the interests of national defense could be more profitably employed through their own appropriation and the development of their own schooling facilities than through any commercial subsidy scheme.

Both Admiral and Secretary of War conceded that the flight training of civilians would be of some advantage to the government in the event of war, and that it would shorten the period of military training required by the beneficiaries of the scheme, but they thought the saving not enough to be worth while. Their objections were summarized, perhaps not fully or fairly but at least quotably, by Senator Clark of Missouri in remarking of the War Department's report: "Well, that just amounts to saying that the War Department does not want some other department to spend money for aviation."

Commerce sympathetic

To the comparatively mild antagonism of the War and Navy Departments the Commerce Department supplied a counterbalance of vigorous advocacy. Director of Aeronautics Eugene L. Vidal "certainly would like to endorse most enthusiastically any assistance that the government can give to this particular phase of the industry." He considered the fixed-base operators "just as necessary in the development of aviation as the air transport group." He endorsed "anything that would help them continue and carry on their good work," and suggested that air transport had had relatively more than its share of government encouragement and fixed-base flying service operation much less than it deserved.

Col. Carroll Cone, assistant director of aeronautics, also stood on grounds of principle rather than of particular legislative language. Plainly the Department of Commerce officials have determined if the Sheppard bill does not pass or does not seem to do the job of supporting fixed-base operation properly, to find some other measure of law or some other device that will do it. Colonel Cone viewed with alarm the fact that some 2,000 private and miscellaneous flyers had during the past two years given up their licenses and quit the aviation field. He attributed their departure in large part to the absence of government support.

Colonel Cone went farther, for he can speak from a military point of view as a wartime pilot of wide experience and as the commander of the National Guard aviation of Arkansas for a number of years. From a national defense standpoint, recognizing that no nation in the world could afford to maintain in time of peace military air forces that would be adequate for war, he called it nothing more than "common sense, good judgment, and economy for the government to encourage young Americans to learn aviation at their own expense so that we may be at least partially prepared in time of national emergency to defend our country in the air." He denied the inadequacy of commercial training for producing pilots fitted for military work, and he put the names of Lindbergh, Wiley Post, and Wedell in evidence of the sort of product that commercial schools could produce. Colonel Cone knew definitely from a survey in the field by representatives of the Department of Commerce "that there are some 300,000 or 400,000 Americans who would like to fly."

Operators speak

Government officials might testify both ways, but civilian witnesses testified in only one. They were unanimous in approving the bill and in proclaiming it an absolute necessity if an important part of civil aviation were to be saved. Former Senator Bingham, president of the National Aeronautic Association, was first to enroll as a member of the cheering section. He thought the Navy's objections shortsighted, and he believed that for the government to aid in the teaching of pilots as proposed in the bill would be "a very estimable use of the public money."

The witnesses from the industry moved in in a mass attack on the Army and Navy opposition. Oliver L. Parks, president of Parks Air College and of the Independent Aviation Operators, described the present Army training method as "the most expensive possible," and at the same time working to prevent the development of civilian schools and providing an unfair competition for their product, since pilots who had paid for their own training must compete for employment against those who had secured it free of charge at the expense of the government. Stanley C. Huffman of the Vermilya-Huffman Flying Service of Cincinnati was particularly embittered on this matter of military competition with the commercial operator and on the War Department's attitude toward both civil and military aviation. With great respect for the personnel of the Air Corps, he felt that it was seriously lacking in military efficiency at the present time because of inadequate flight experience, and he estimated that the men represented in the flying-service-operator group would "fly throughout a year about five times as much as your average Air Corps pilot flies."

Aviation as character-builder

And so they went, with many quotable expressions. Unfortunately only a few can be selected. Mr. Parks believed we should have five or ten times the present number of pilots and that even a 25 per cent reduction in the cost of training to the individual would bring in a large group of entirely new students. He believed that the fundamental value of aviation was its contribution to the moral and physical improvement of the nation's youth by taking them away from unwholesome entertainment, from dissipation, and from indoor pursuits, and Senator Sheppard said that "that is one of the best arguments I have heard." E. W. Hudlow, of the Spartan school in Tulsa, had a similar idea. He had met young people in many large groups (just recently 525 high school seniors had visited his school in a single day) and had found them all eager to learn of aviation.

Jack Lenox, deputy commissioner of aeronautics in Connecticut, told the tale of the gypsy flyer of ten years ago and of the hard lot of the typical small operator of today. Many airports had closed and many more would do so unless the government came to the rescue. Fred L. Smith of Ohio also dwelt on the airport problem and upon the great number of airports that are today being maintained and kept available to those who fly, simply by the devotion to aviation of one or two commercial operators and their dogged unwillingness to quit. Milo Oliphant of the Michigan Board of Aeronautics made a similar point.

The hearing ended, and the committee took the matter under advisement and as we go to press it has not yet reported. One thing is sure, whatever the report may be, the effort to secure government support for the flying service and the small airport operator will continue. Already it appears at many points, and many Congressmen have expressed interest for the Sheppard bill is but the foundation of a pyramid to which have been contributed a number of other pieces of legislation not yet made the subject of formal review. Particularly significant among them are measures providing for direct subsidy of private ownership (by government contribution towards the price of a plane) and of subsequent operation of the privately owned ships.

To See or Not to See

A question of considerable importance to the airplane pilot

THERE are few airplane prospectuses or specifications that do not contain some such words as "the vision from the pilot's seat is practically perfect," or at least "practically unobstructed in all essential fields." Unfortunately such statements are virtually meaningless, for heretofore there have been few available means to analyze pilot vision quantitatively. Some efforts have been made to chart fields of fire or fields of vision for military aircraft while in flight, but at best no satisfactory criteria have been established against which to compare the vision characteristics of airplanes in flying and landing attitudes.

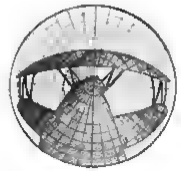
Recognizing this deficiency, a research program has been under way for some time at Langley Field under the direction of Mr. Melvin N. Gough, N.A.C.A.'s assistant test pilot, to establish some sort of measurable vision coefficient which can be applied to all airplanes for comparative purposes. Essentially, the Langley Field method consists of considering a point midway between the pilot's eyes (when seated in the cockpit) as a center of a sphere of any convenient radius and then projecting the outline of the airplane and its appurtenances onto the sphere. Horizontal and vertical planes passing through the center of the sphere with their intersection in the direction of flight, are used as references and the point of their intersection on the sphere is the origin used when plotting the data on polar charts. The larger figure in the illustration shows the method and the smaller figure represents a typical chart obtained for a representative airplane. The chart shows the airplane in a landing attitude. It will be noted that one-half of the diagram represents the field of view when the pilot's head is centered in the cockpit and the other half gives the field of view when the head is shifted to one side within the limits of the cockpit opening, as is common practice when making landings. Although the original charts were projected from a point source as indicated above, a correction has been developed which takes account of the binocular vision of the pilot and effectively reduces the apparent width of obstacles in the same plane as the eyes.

An instrument known as the "Visioneter" has been developed to be placed in the cockpit of an airplane on the ground from which the angles determining the projected outline of the airplane on the sphere can be read. They are then plotted on the circular polar charts. The polar type of diagram is particularly adaptable for this purpose, as it presents true surface areas and allows the use of a planimeter for making direct comparisons of blind and open zones.

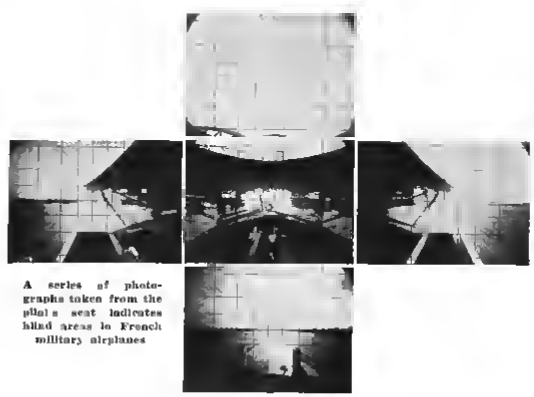
According to the Revue des Forces Aeriennes' for October, 1933, the French Air Ministry is working on the same problem in a slightly different manner. A camera mounted in trunnions is placed so that its optical center is at the normal position of the pilot's eye when in the cockpit. A series of five photographs representing five sides of a cube (forward and aft, right and left, and overhead) is taken through specially prepared screens (on which proportional distances are laid out to aid in measurement), and from which the obstructed areas may be determined. A typical set of such photographs appears on this page.

For anyone interested, AVIATION *has available a number of blank polar charts similar to those used by the N.A.C.A. and samples will be mailed upon request from any reader. It would assist the work of the committee materially to have as many charts as possible turned in to illustrate the opinions of pilots and engineers as to an 'ideal' vision specification for an airplane.*

In the N.A.C.A. pilot vision analysis the outline of the airplane is projected on a sphere whose center is the pilot's eye



A typical vision analysis chart for a single seat fighter. (Pilot's head centered in left half of chart,—head moved to right in right half.)



A series of photographs taken from the pilot's seat indicates blind areas in French military airplanes

Transportation in China passes from ancient to modern, omitting the intermediate stages

Following the West,—

China becomes one of the World's great aeronautical frontiers and one of the greatest of markets

By Harrison Forman

CHINA has too long depended upon its few great rivers for contact with the outer world and its maze of canals for internal communication. With a nature not easily given over to radical change, she has been rather reluctant in availing herself of the Western automobile and locomotive. The result has been comparative slothfulness, until the sudden awakening to national consciousness by the revolution in 1911.

With an area comparing in size with that of the United States, and with a population almost four times as great, presenting an almost unlimited market for the world's products, it is to be deplored that the commercial highways in China remain in such an undeveloped state.

When the airplane first came to China its sponsors were surprised to find an excellent potential for the expression of its manifold services, with an almost negligible amount of competition present from its two major rivals, the automobile and the locomotive. Aviation promoters were jubilant. Routes were laid out, criss-crossing the entire country, effectively tapping the most important productive and commercial centers. Capital was quickly and easily raised and orders were placed for quantities of aeronautical equipment.

This wave of optimism was quickly damped by the repeated experience of having material confiscated by ambitious military men upon arrival, and subsequently diverted to military uses. The government recognized this danger and placed a stringent ban upon the importation of all aeronautical equipment into the country. The government also realized that with an efficient air force it could easily awe and subdue the ever-present recalcitrant elements. It therefore created a Bureau of Aeronautics which was placed directly under the supervision of the Ministry of War and placed orders for a number of squadrons of the latest type of military aircraft.

With the establishment of an aviation division in the government it was necessary at the same time to institute primary and secondary flying schools to train pilots. These schools are under the able supervision of Chinese instructors assisted by foreign advisers. The government is turning out quite a sizable number of reserve pilots to prepare for the day when conditions will permit the progression of commercial aviation.

Aircraft manufacturing

The time was bound to come when China would desire to build her own aircraft. Anticipating this, a number of proposals were submitted to the government from time to time by foreign interests detailing plans for the establishment of factories for the manufacture of aircraft in China, but they were rejected one after another for various reasons. A Dutch proposition failed because of lack of confidence in the government's official banking organization, and a German project (which on the face of things appeared most attractive of any submitted) was rejected because of the suspicion of an artifice suggested by a clause in the contract.

Only a short time ago, however, the Curtiss-Wright interests effected a contract with the Chinese Government for the establishment of a huge aircraft factory for the manufacture of various forms of American-type aircraft.

China has, nevertheless, made a serious effort to manufacture her own aircraft. A Naval Air Establishment was organized at Swatow in the Province of Kwangtung, and another in Foochow, Fukien Province, in 1918. These were headed by Chinese aeronautical engineers who had received extensive training in England and America. The Swatow factory has recently transferred its major operations to Canton, while the Foochow plant has been moved bodily to Lungwha, Shanghai. These organizations are still in operation. They do not conflict with the American factory since their main interest is to experiment and to carry on research in the use of as much native material in the way of wood, fabric, paints, etc., as they may find available.

Transport

In the late fall of 1929 the first major commercial airline was started by China Airways, Inc.—an American company, operating under a franchise from the Chinese Government. Their equipment consisted of Pratt & Whitney Hornet-powered six-place Loening cabin amphibions. The line ran from Shanghai to Nanking in competition with a government owned line operating Stinson landplanes powered with 300 hp. Wright "Whirlwinds."

In July, 1930, the two lines merged into the present China National Airways Corporation—in which the government held a 55 per cent interest and China Airways, Inc. (a subsidiary of Curtiss-Wright) retained a 45 per cent minority. The line was extended to Hankow, operating on a daily-except-Mondays schedule, with stops at Nanking, Anking and Kiukiang.

May, 1931, saw the inauguration of the Hankow to Chengtu line. At first it operated only to Ichang, via Shasi. In October, 1931, it was extended to Chungking, Szechwan, via the far-famed Corges of the Upper Yangtsze, calling at Wanshien. Since June, 1933, it has been operating to Chengtu. The Hankow-Chengtu line flies on a weekly schedule.

In addition, the CNAC instituted in January, 1933, the Shanghai to Peiping (Peking) airline, and the Shanghai to Canton line a few months later. The Shanghai-Peiping run operates on a thrice-weekly schedule, and calls at Haichow, Tsingtao (the "Riviera of the Orient") and Tientsin. The Shanghai-Canton line runs a daily service to the south with stops at Wenchow, Foochow, Amoy, Swatow and Hong Kong.

The equipment of the CNAC consists of six Loening amphibions, five Stinson landplanes with three ships kept in reserve. A number of bi-motored amphibions are on order from America. The personnel numbers ten Americans, one German and one Frenchman, with Chinese co-pilots.

Shanghai to Berlin

In May, 1931, the Eurasia Aviation Company was formed to operate an air mail and passenger line between Shanghai and Berlin. This was quite an ambitious undertaking. It called for an express airline to extend from Shanghai to Nanking, northward to Peiping, and then northwestward across Mongolia and Siberia to connect with established European airlines. Unfortunately, through lack of co-operation on the part of the Soviet Government, which refused permission to the Eurasia Company to operate its ships across Siberia, it was found necessary to break the air journey at Manchouli, and transfer passengers and mails to the Trans-Siberian Railway for the journey across Siberia. This line operated for only a few short months, owing to the outbreak between the Chinese and Japanese in Manchuria.

In March, 1932, the Eurasia Aviation Company began operations on a line which started from Nanking and touched at Loyang (Honan), Sian (Shensi), and Lanchow (Kansu). Weekly service for mail and passengers was instituted. Shortly thereafter, the line was extended from Nanking to Shanghai at the one end, and on to Urumchi, or Tihwa capital of Chinese Eastern Turkestan, from Lanchow via Suchow and Hami. A line running from Peiping to Sian to connect with the Shanghai-Urumchi service was also added.

The fortnightly service from Lanchow to Urumchi was temporarily discontinued recently, owing to disturbances in Sinkiang (Chinese Eastern Turkestan).

It is hoped to extend the Shanghai-Urumchi line to Tchukuchak, on the Russian border, then to Semipalatinsk, to connect with Soviet airlines, and thus give a service of Shanghai to Berlin in six days—or four days, if any night flying is done.

The equipment of the Eurasia Company at the present time consists of six Junkers all-metal, low-wing monoplanes. They have accommodations for four passengers, pilot and co-pilot. They are equipped with radio. The personnel is entirely German.

Several smaller airlines have been opened in various parts of the country. Plans are already prepared for connecting Sian with Canton, via Siang-kiang, Hankow and Changsha (Hunan). Also, Sian to Peiping, via Taiyuan.

Trade awaits transport

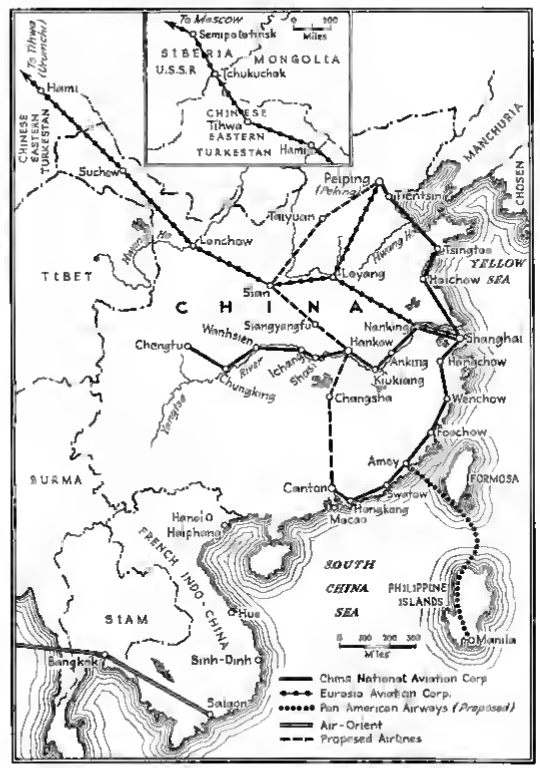
A vast potential wealth awaits only developed transportation facilities for exploitation. Rice, wheat, furs, silks, musk, and minerals, all are products of the far interior places; which could be developed into highly lucrative trade items in exchange for foreign products when the airplane shall bring them within a few days of the coast, instead of a few weeks or even months as at present.

For example, it takes three or four days by fast steamer to transport merchandise and passengers between two of the greatest commercial centers in China—Shanghai and Hankow. The air service makes the trip in seven hours. From Chungking, wealthy capital of Szechwan, and commercial focus for all western China, it is a journey of two weeks or more through the treacherous Gorges of the Upper Yangtsze to Shanghai. The airline makes it in *two days*. From Shanghai to Urumchi in far-off Sinkiang it is a tedious three to four months journey by mule-cart over arid deserts and barren mountains, infested with bandits. The Eurasia planes make it in *four days*.

And the Chinese are extremely air-minded too. The Eurasia line reports that it carried 589 passengers and 11,303 lb of mail and freight in 1932; while the CNAC carried 3,153 passengers and 48,014 lb of mail and freight during the same period. Upon a recent trip into the interior, I had to wait five weeks in Lanchow for passage to Shanghai in one of the Eurasia planes—even though they had placed two, and sometimes three, planes on the weekly run.

Pan-American Airways has recently taken over from China Airways, Inc., the 45 per cent minority interest in the CNAC. It has extensive plans in prospect. A trans-Pacific line is to be established connecting China with America, via Alaska, The Aleutians and Japan. It is then planned to connect with the Dutch K L M. the British Imperial Airways and the French Paris-Saigon lines, which are all planning to extend their services to Hong Kong.

Pan-American also plans to run a line from Shanghai to Manila. The route will jump across to the southernmost tip of Formosa from Amoy, and then follow a line of tiny islands to the northern end of the island of Luzon in the Philippines, whence the coast will be followed down easily to Manila the terminus. An alternate route to the Philippines would be to make the 700-odd miles hop across the open sea from either Hong Kong or Macao to Manila.



Air routes in China—existing and proposed. The CNAC stop indicated at Haogchow is not regularly made but undoubtedly will be after the Curtiss-Wright factory is in operation

EDITORIALS

AVIATION
EDWARD P. WARNER, *Editor*

Things are Looking Up

VIEWING WITH ALARM is a distasteful procedure, and one which is always a pleasure to stop. Unfortunately we have had a lot of it to do in the last two or three months and it is with profound relief that we seize on the chance to herald the end of the head-shaking period and the coming resumption of orderly development.

For this has been upon the whole a month of good news. The various drafts of air mail legislation have undergone amendments that have eliminated the most vindictive and the most severely penal of their provisions. Alternative bills concerned purely with the establishment of future transport service on the soundest possible lines have been offered. The elaborate interlock of military and commercial aviation which marred the original form of the legislation first taken up by the Post Office Committees has been suppressed and replaced by a mild and a perfectly reasonable arrangement for interchange of information between the operating personnel of the air lines and the air forces. One of the most strangely persistent features of proposals for air mail law, the placing of a flat top limit upon the maximum payment per mile that could in any event be received, without regard to the extent to which mail loads might increase, has totally disappeared from the latest Mead bill.

THE FIRST OPENING of air mail bids on the temporary scheme was on the whole encouraging. The proceedings had somewhat the aspect of a poker game, for many of the bids were palpably determined without any relation whatever to the costs of operation, being based simply on a guess at what some other fellow might offer. Grotesque inequalities of compensation will result. That was and always will be the consequence of applying competitive bidding in a field inherently unsuited for it. Still it is possible to draw comfort from the fact that most routes (certainly more than two-thirds of the total number) seem certain to remain in the hands of experienced organizations with proper equipment. On the other hand, at least a few of the "independents" not hitherto carriers of the mail are likely to get a chance to display their own capacities. The plans that some of them announce and the equipment that they possess make it plain that their operations will be of a somewhat different order from those previously maintained by the larger companies with a mail-carrying background. Now we can cease speculating about the relative qualities of low-cost and higher-cost operations and about the relative acceptability of particular types of service for passengers, mail, and express. Selected routes will serve as a laboratory for subjecting the operations of the independents, proud of their capacity to make economies, to the test of public approval. Incidentally some of their costs will be subjected also to the test of group pressure, for scales of employee compensation which may have seemed quite acceptable in a small operation known to be struggling along at a loss without any support other than that of a meagre passenger traffic, and having to seek the co-operation of its employees to keep going at all, will look quite different when the same company becomes a mail contractor receiving monthly checks from the United States Government. There will be a very natural pressure for uniform scales of compensation on all mail-carrying lines, and that too will work itself out under conflicting pressures and in final accommodation to public opinion over the next few months.

TO CONTINUE this note of optimism, unwonted as it is but now happily warranted at least in certain areas, the situation relative to the procurement of military aircraft also shows some signs of improvement. The realization that the problems of aircraft development and manufacture are highly specialized and must be so treated spreads. The clamor of denunciation of Army and Navy attempts to develop the most logical and efficient procurement devices available within the framework of existing law, by taking advantage of whatever opportunities have legitimately existed, subsides. Brightest particular spot of the month's record is an address in Congress by Hon. Ross A. Collins of Mississippi, Chairman of the Military Subcommittee of the House of Representatives Appropriation Committee, assailing this newly-cherished doctrine of standardized employment of unrestricted competitive bidding for aircraft procurement and frankly and explicitly asserting the necessity for some freedom to negotiate in order that the best equipment, and not merely the cheapest, may be secured.

BUT the best news of all is saved for the last. In our April issue we pled that the President appoint "a board of distinguished citizens of varied interests and points of view" to survey the whole field of air policy and recommend concerning it. The President has now elected to do just that. The commission is in the making, and given a proper membership and proper conditions under which to work it may effect an even greater revolution for good in our aeronautical affairs than did its predecessor of 1925, assembled under the chairmanship of Dwight W. Morrow. The section of the new Mead bill concerning the matter and the joint resolution sponsored by Congressman Vinson, himself a member of the Morrow Board, create a proper framework. Some such resolution will pass as a matter of course. The next six months should be a formative period and one of investigation, but of investigation of a highly constructive order. The first President of the United States ever to fly in an airplane either before or during his term of office now has a rare opportunity to take full advantage of experience and to establish a clearer and a more coherent air policy than we have ever up to now enjoyed. At this moment, he gives every evidence of desire and intention to do just that.

To be sure, there is no place for professional Pollyannas. Serious conflicts still lie unresolved, and innumerable claims on account of past governmental action are yet to be adjudicated. Nevertheless hope has succeeded panic, and one need be no Pollyanna to believe that from here on we shall upon the whole go forward, and that within a year American aviation will be on a true course, a mixture of old influences and new, and running at full throttle.

Records to Make

THE INTERNATIONAL BODY that deals with aviation as a sport and with the certification of aircraft performances recognizes today 21 records for land planes (not counting the various light-plane classes) and eighteen for seaplanes. Of that total of 39 established figures, only six stand to the credit of the United States. A shocking fact about which action should be taken.

Fortunately the action indicated is simple enough. We need no elaborate and expensive program of engineering development and experiment, and no hazardous ventures with engines tricked up for a few minutes running or with 120-mile landing speeds, to take into camp a good share of the records, and those the very ones that apply most directly to commercial and military operation. In the practical employment of aircraft it is not the ability to rocket over a three-kilometer course with the combined power of several locomotives used to carry a single man on close-clipped wings that matters most. The figures that count are those for speed over long distances, and especially for speed climbing power with commercial load, and those are the figures that hang temptingly from the branch, ready for plucking at any moment by the American industry. To select particular examples is likely to be risky, but there come easily to mind instances of machines that are already showing standard service performances well above the level of the existing world's records in their classes. Other planes, equally capable in their various divisions, are on the way through the shops and approaching readiness for test. All that is necessary is for manufacturers or operators to decide that these records have enough importance to be worth going after, and with no more trouble than the arrangement for official timing and possibly in a few cases the installation of extra gas tanks the thing will be done. When we see upon the statute books an unrestricted seaplane speed record over 1,000 kilometers (621 miles) of 138.1 miles an hour, we raise no question of whether or not that record can be changed from German to American, but only of whether or not any one of the factories able to do it will take the trouble.

We hope they will. We hope it as a matter of national prestige, as an answer to the outrageous campaign tradncing the qualities of American aircraft that renews itself from time to time and that has been particularly virulent in the last few months, and as a measure of direct commercial advantage to the American industry and to the companies concerned. The book of recognized records is regarded with respect in many countries, and when we proclaim the extraordinary performance of American aircraft it is natural for foreign skeptics to ask why none of this shows up in the lists of the International Aeronautic Federation. Today the United States holds six records out of 39 in the airplane categories. At a very conservative estimate, fifteen of the remaining 33 could be annexed by existing types of American aircraft within the next three months. We suggest that it be done, and we recommend it as a good investment.

[The Sikorsky company was acting almost as the foregoing lines were being written. Just as we are on the point of going to press we receive word of the breaking of two international records by the new Super-Clipper. Several more of the established figures lie within easy reach of the same machine, and will no doubt be knocked over in due course. Let others follow the example.]

Clean Up and Paint Up

VISITORS to Langley Field in the years immediately following the War will recall that for a long time a pursuit airplane stood just within the gate as a sort of trademark. Always it was a machine long obsolete and condemned as unfit for flying, but always

it presented a pleasantly shiny appearance to the casual visitor No matter what condition its structure might have debilitated into, never more than a few weeks went by without its receiving a new coat of paint Whatever its aerodynamic obsolescence and its structural incompleteness might be, at least it remained an aesthetic credit to the field

And there we have an object lesson for many an operator of flying service As we go about the country we encounter all kinds of planes at all kinds of airports Those that are licensed by the Department of Commerce and that offer themselves for the patronage of a public on joy riding or aerial sight-seeing bent are, as a matter of course, in sound structural condition The fabric is taut, and the fittings and brace-wires and controls are properly inspected and free from corrosion or undue wear But all that, important as it is, is not enough The visiting public from which the patrons of flying service must be drawn makes no effort to inspect the controls, but it does inspect the color scheme of wings and fuselage When, as too often happens, the paint has grown dingy, and blues have dwindled into grays, and insignia have flaked away, and old color schemes show up through new ones, passengers that ought to be pausing to pay their fees and ride are being driven away

Less important than the appearance of the airplane, but not much less important, is the appearance of the personnel and of the grounds With a dingy airplane, and a pilot who has the appearance of having just crawled out from under his car after a repair job, and a barker and ticket-seller arrayed in once-white overalls caked with grime, no profitable business will be done Most airports are dusty places at best, though even the dust can be much reduced by proper treatment of the surface and proper handling of the airplanes Dusty or not, however, neither the airports nor the planes that operate from them nor the men that work around the planes need be unsightly and unkempt These may seem little things, but they are the horseshoe nail about which we wrote a few months ago, for the want of which a battle was lost

This ought to be a good year for flying services and schools More men and women are employed than for at least a couple of years past, and they have more money to spend In a campaign to get them to spend it on airplane rides and flying instruction rather than on other things, a first-rate spring housecleaning—frequently repeated—plays an important part

New Types of Aircraft, New Uses

WHEN attempts were first made to build airplanes with metal, the first disposition of designers was to put a piece of metal wherever there had been a piece of wood, and to conform as exactly as possible to the structure with which they had grown familiar When the sale of aircraft for private ownership began to be studied on a large scale, the immediate and natural impulse was to follow with an almost slavish devotion the practices that had proven successful in selling automobiles To look back a bit into the dawn of another industry, when the first automobiles were constructed many of them were held with such minute faithfulness to the accepted traditions of carriage manufacture that they were even equipped with whipsockets

In short, human people love analogies and precedents, and when there is a new thing to be done we seek if possible to do it exactly like an old one The really individual thinker who analyzes the new problem and introduces an entirely new answer is always the exception It has been that way in engineering and in manufacturing and in merchandising, with aircraft as with other products It has been that way, too, in operation

The autogiro appeared on the American market some five years ago as a fundamentally new type with fundamentally new characteristics Out of every 100 people that thought about its employment at all, probably 98 thought of it as being used exactly like an airplane. Suggestions were made from time to time for specialized autogiro jobs that the airplane could not have done as well or at all, but the search for such suggestions was the exception. The general rule was to consider the rotative aircraft as just a new type of airplane, and to judge it by airplane standards It is in fact recorded that a Department of Commerce inspector threatened to withhold his approval for one commercial autogiro because it could not be spun and because its longitudinal stability prevented dives steeper than 45 deg

BUT the autogiro and other types of rotative-wing aircraft are not airplanes in any sense whatever, and they must be studied upon an entirely new basis They have new and special functions We have not yet had enough experience to know what those functions are or how far they may spread, but we do know that they are special, and to criticise one type of craft because it cannot duplicate the performances of another type is an absurdity. The automobile has largely replaced the riding horse as a means of personal travel, but it is not even yet as good as the horse at jumping fences There are things that the airplane can do better than, for instance, the autogiro, but there are also things that it cannot do as well The government departments interested in aviation ought to find out what those things are, and to probe all the possibilities of any fundamentally new type They have not yet done so on any adequate scale Neither the military nor the commercial possibilities have been fully explored It is most particularly a matter for frank astonishment, and we find it a matter for real regret that the Department of Commerce does not today possess a single autogiro for the use of its personnel

NEWS OF THE MONTH

New bid specifications

ON MARCH 30, two days after Postmaster General Farley's announcement that the air mail service would be returned to private contractors as soon as possible (AVIATION, April, page 118), the Post Office Department issued advertisements for temporary bids for 21 routes, and followed them with a second set of advertisements for four additional routes one week later. It was required that the first bids be submitted by 4 30 p m on April 19, for public opening at noon, April 20; the second set, by 4 30 p m on April 26 to be opened publicly on April 27 (See story of bid opening on page 135.) Successful bidders are required to start operations within 30 days after the contracts are awarded The rate of pay is to be based on definite weight spaces available per airplane mile (one cubic foot being computed as the equivalent of 9 lb of air mail) but in every case a maximum payment per airplane-mile has been fixed by the Post Office Department, ranging from 41 cents to 45 cents, regardless of the amount of mail actually carried.

Premiums for night flying or for additional safety equipment provided for under the McNary-Watres formulas, were not mentioned in the new advertisements.

Former mail contractors and the independent operators after perusing the eagerly-awaited bid invitations pronounced them to be both contradictory and confusing When, finally, through consultations with the post office officials the language of the bid invitations was fully understood, few prospective bidders were satisfied The former air mail carriers charged that the specified minimum cruising speed of 110 m p h was absurdly low, in the light of up-to-date airplane design, and that the government was thereby coddling the independent operators to the detriment of the development of air transport by enabling them to use older and slower planes. In their turn the independents wailed that inasmuch as multi-motored planes were required over mountainous terrain, and in some cases for night flights, they were at a disadvantage since many of them did not have multi-motored equipment and would not be able to obtain it within 30 days Much criticism was leveled at the provision which allows different types of equipment on different parts of the same route, on the grounds that changes of equipment would cause considerable inconvenience as to seating passengers. For example, on the transcontinental route from Newark to Oakland, Cal., multi-engine planes are required over the Alleghanies and the Rockies, but between Chicago and Cheyenne single-engine planes may be used Complaints were made also that the Post Office Department had not indicated specifically what was meant by its use of the term "safety features"

The greatest hue and cry of all arose when it was alleged that American Airways would be placed in a uniquely favorable position by the terms of the bid invitations, since none of the present officers of the company were in office at the time of the May 1930 conference, and a minimum of reorganization would be required [As related on page 137 of this issue, the bidding did not by any means turn out that way] The Post Office Department took enough cognizance of the rumors to issue a statement denying all charges of favoritism and asserting that in some respects American Airways seemed subject to peculiar hardship under the new specifications

In the midst of the turmoil, American Airways quietly had itself re christened American Airlines Inc under Delaware laws, with an authorized capitalization of 5 000 000 shares at $1 par The stock of the new company is to be issued to the Aviation Corporation, which had 100 per cent ownership of American Airways and the shares in turn will be distributed proportionately to stockholders of Aviation Corporation Cord Corporation, at the close of 1933 held 822,000 shares of Aviation Corporation, and the holdings in American Airways which it will receive are to be distributed to shareholders on a pro rata basis, thus detaching the company completely from holding company control The officers and directors of the new operating company were selected from among the operating personnel and are entirely distinct from the officers and directors of the present holding or manufacturing companies

United Aircraft and Transport Corporation in its annual report to stockholders, issued on March 28, broached the outlines of a plan for re-organization to be effected in the near future According to the proposed plan, the corporation will divorce its air transport subsidiary from its manufacturing companies, and separate these interests into two components, one at Seattle, Washington, and the other at East Hartford, Conn Each of the three units of the corporation is to be a distinct entity with different officers and directors The parent company will cease to function and probably will be dissolved Details of the reorganization and division of stock interest have yet to be settled, the report said With the announcement of the projected changes President Philip G Johnson included a statement dealing with the annulment of the air mail contracts, asserting the innocence of the member companies of the United system and of their officers of any fraud and collusion in connection with contract awards Copies of letters and telegrams registering protest against the annulment and demanding hearings which were sent to Postmaster General Farley by the transport subsidiaries of United and by the corporation as well, were included in the statement. No reply was ever received to any of these communications, President Johnson said.

As postal officials and operators quibbled over bid specifications, Lt Thurman A Wood flew west from Chicago in a pursuit plane with 23 mail pouches, crashed in a rainstorm over Iowa. He was the twelfth Army flier to die since the cancellation order A route between Chicago and St Paul was added to the Army service on April 8

Calendar

Indefinite—Dedication of Pan-American Airways System's International Marine Airport, Dinner Key Fla.

May 27—Coupe de la Meurthe Cup Race France

June 9 10 — Coupe Mondiale d'Aerobatic Aerienne (International Aerobatic Competition), Vincennes, Paris, France

June 15 October — Exhibition of Italian Aeronautics, Milan, Italy

June 17-22—Summer Meeting Society of Automotive Engineers Lake Saranac, N Y

June 19 24—Pacific Coast Meeting Society of Automotive Engineers University of California Berkley, Cal

June 26 July 8—Annual meeting Soaring Society of America, Elmira, New York.

October — MacRobertson International Air Race, London to Australia

November — Viceroy's Challenge Trophy 760 mile race India

and a twenty-hour New York-San Francisco run is planned as soon as enough new Martin bombers, now being delivered, are on hand. The Army's mail service, deplorably bad and irregular during the first few weeks, improved immensely as spring weather came on and as pilots improved their acquaintance with the routes.

Rebuttal

A counter offensive against the air mail cancellation and subsequent policies of the Administration was launched at hearings before the Black Investigating Committee by Senator Warren R. Austin, its senior Republican member. Co-author of the Austin-Barbour-Davis Air Mail Bill (see page 155) which compels restoration of contracts to former mail carriers until fraud is proven in court, Senator Austin summoned witnesses and produced documentary evidence purporting to show that the cancellation was the successful culmination of high-powered lobbying of independent operators avid for the contracts of rival airlines. Specifically, Senator Austin charged that the unsubsidized operators organized under the name of Independent Scheduled Air Transport Operators' Association immediately after the Democratic push-over in 1932, and that by propaganda and lobbying they effected the appointment of a special Senate Investigating Committee, and contrived also to bring about in the first session of Congress the rider to the Independent Offices Appropriations Bill, authorizing the President to cancel contracts upon 60 days notice, public hearing, and payment of damages.

The President was misled into support of this policy, so Senator Austin stated, by written representations from the Solicitor of the Post Office and an attorney from the Department of Justice who distorted the facts of the case in order to convey the impression that under Postmaster General Brown certain contracts were extended illegally for six months without authority of law and without re-advertising for bids.

Star witness called by Examiner Austin was William I. Denning, clever Washington lawyer for independents. Correspondence between Denning and T. E. Braniff, president of the Independent Air Transport Operators from the advent of the Roosevelt Administration up to the contract annulment, was produced as proof that the independents had urged that the feeder lines be divided up among the small companies. Testifying about his efforts to obtain "relief" for independent operators, Denning said that as early as November, 1933, S. A. Cisler, Superintendent of Air Mail, had "indicated" that some change might be recommended in air mail regulations to permit independent companies to obtain contracts.

In their testimony W. W. Howes, first assistant postmaster general, and Harllee Branch, second assistant in charge of air mail, emphasized the fact well known to official Washington, that "swarms" of independents continuously besieged the Post Office Department seeking to obtain contracts.

On April 20, while Republicans fumed, Senator Black coolly announced that the committee would suspend hearings in order to devote its time to discussion of the pending air bills and to conserve its remaining resources for further probing of the merchant marine.

Air Commission

The turbid air mail legislation atmosphere became somewhat clearer on April 16 when President Roosevelt put into precise form an idea hinted at before [and editorially urged in AVIATION last month] and instructed Congress to take the first step toward providing the United States with a unified air policy. The President suggested that a commission be authorized to make an immediate study of all phases of aviation and recommend to the next Congress a broad policy for aeronautical activities and the government's relation to each. For the interim before the adoption of this policy the President proposed short-term mail contracts of one year, to be awarded on the basis of competitive bidding. Advised of the plan at a White House Conference, Senators McKellar and Black and Representative Mead, chairmen of committees most concerned with air mail legislation, hurried back to their desks to draft amendments to their bills which would embody the President's recommendations. Their enthusiasm was shared by most Congressmen, seeing in the light of recent experience the wisdom of delaying permanent air mail legislation until a more deliberate analysis of the complicated and generally unfamiliar problem could be made.

Of the 40-odd air mail bills introduced in the House and Senate, the McKellar-Black Bill (AVIATION, April, page 101) has continued to maintain its position as the bill most likely to be passed in this session. After several rewritings the bill assumed a greatly changed (and improved) appearance. The third version, as reported out of committee, does not attempt to penalize the former mail contractors beyond stating that no company shall be eligible to bid if it has an officer who entered into any unlawful conspiracy to prevent the making of any bid. Another provision allows prosecution of cancellation claims against the government within one year from the date of passage of the bill. It is still required that transport companies be divorced from manufacturing affiliates and interlocking directorates are prohibited. A gain for operators is the deletion of the clause requiring military and naval co-pilots.

No change was made in the payment provisions which fix the rate at a maximum of 30 cents per mile for carrying 300 lb. of mail and 6 cents per mile for each 200 lb. thereafter. The absolute maximum is placed at 40 cents per mile, regardless of the amount of mail carried. A postage rate of 6 cents per ounce is proposed. At the end of nine months the Interstate Commerce Commission would assume control of air transport, including mail contract awards and payments. In line with the President's wishes, amendments were added providing for an aviation commission of seven to be paid not more than any member of Congress, and limiting the tenure of contracts to one year instead of three. So amended, the bill passed the Senate on April 28.

The newest Mead Bill, introduced in the House shortly after the President's announcement, provides for a commission composed of five Presidential appointees, none of whom would be government officials. The commission would cease to exist upon making its report, which is to be submitted not later than Jan. 3, 1935.

The bill provides that contracts for periods not exceeding one year are to be awarded by the Postmaster General to the lowest responsible bidders. Payment for mail carrying would be at the base rate of 35 cents per airplane-mile for the first 300 lb., plus one tenth of the base rate for each additional 100 lb. of mail or fraction thereof, computed at the end of each calendar month on the basis of the average mail load carried per mile over the route during the month. There would be no absolute ceiling on the rate of payment. The postage rate is fixed at 5 cents per ounce. The bill permits prosecution of cancellation claims against the government, and specifically states that the Act of 1872 shall not be invoked to disqualify former contractors from bidding.

Since its introduction in the Senate, the McCarran Bill which provides that the regulation of air transport, including air mail financing, be placed in the hands of a Federal Aviation Commission, has been hailed by aviation experts as the most constructive of the proposed measures. It was steadily winning more and more support in Congress when the Presidential recommendations for an investigating commission stole its thunder and substantially reduced its immediate prospects. Coming from the junior Democratic member of the Black Investigating Committee, the provisions of the bill are in many respects remarkable. It would authorize the Federal Aviation Commission to issue certificates to operators best qualified to perform service. There would be no competitive bidding, and no attempt to punish former contractors for their alleged misdeeds. Pending the final fixing of rates by the commission, payment would be on a pound-mile basis and on a sliding scale. A gradual end to all mail subsidies is provided for.

The Republican opposition bill, of which Senators Austin of the Black Committee and Barbour and Davis of the Post Office Committee are co-authors, was presented in the form of an amendment to the McNary-Watres Act, and attempts to "assure the future status of the air mail operators and remove uncertainty and insecurity in order to encourage long-time planning." In accordance with the terms of the amendment this would be done by empowering the Postmaster General to issue route warrants for a period of not more than ten years without competitive bidding. Mail rates would be fixed at two mills per pound-mile and an outright subsidy would be paid as well, according to a formula to be devised by the Postmaster General. Subsidy payments would take account of improvements in service and equipment and of improved flying technique. In addition to the provision demanding restoration of contracts until fraud be proven, the bill would allow suits against the government for contract annulments, and furthermore would force the Postmaster General to prove his case in court before he could disqualify companies from bidding because of alleged collusion and fraud.

Operators sue

Postmaster General James A. Farley was served with complaints in four suits instituted in the Supreme Court of the District of Columbia by four allied transport companies to enjoin him from enforcing his order of Feb. 9 under which the mail contracts were withdrawn. Damages accruing to date resulting from the cancellation will be demanded. The four companies filing the suit are Boeing Air Transport, National Air Transport, Pacific Air Transport and Varney Air Lines, operating subsidiaries of United Air Lines. The bills of complaint charge that James A. Farley arbitrarily and in a manner contrary to law cancelled the contracts of these companies without giving them any notice or any opportunity to present the true facts. Mr. Farley is sued as an individual and not as Postmaster General on the theory that he had no power in his official capacity to annul the contracts without notice and hearing.

The bills of complaint set forth that all of the contracts obtained by the four companies were awarded to them in accordance with law and as a result of open competitive bidding. These contracts were made from one to five years prior to the meeting which Farley claims resulted in a combination to prevent bidding on contracts. In accordance with the provisions of the Watres Act these original contracts were exchanged for route certificates duly issued by the Post Office department and conferred upon each of the companies the right to carry the mails over the respective routes for a period of approximately ten years from the date of commencement of operation under the original contract.

The suit of Transcontinental & Western Air, Inc., as James A. Farley and John J. Kiely (AVIATION, April, page 120) was granted an appeal in the United States Circuit Court of Appeals and will be heard on May 7.

Air Corps board

To find out what, if anything, is wrong with the Army Air Corps Secretary Dern's investigating committee (AVIATION April page 117) got under way on April 17. The civilian members of the committee which is headed by Newton D. Baker, former Secretary of War, are Dr. Karl Taylor Compton, president of Massachusetts Institute of Technology; Dr. George W. Lewis, executive director of the National Advisory Committee for Aeronautics; Edgar S. Gorrell, former Air Corps colonel and now president of Stutz Motor Car Company; Clarence Chamberlin, and Major James H. Doolittle. The military members comprise Major General Hugh S. Drum, deputy chief of staff and executive vice-chairman of the committee; Major General George S. Simonds, commandant of the Army War College; Major General B. D. Foulois, chief of Air Corps; Brigadier General Charles E. Kilbourne, Assistant Chief of Staff, War Plans division; and Brigadier General John W. Gulick, with Major Albert E. Brown as recorder. In his instructions Secretary Dern admonished the committee that their business

TRANSATLANTIC HOPES

Sikorsky's S-42 takes the air in tests in less than 30 seconds with 8 tons aboard. Later she climbed to 8,500 ft. in little over seven minutes,—showed 198 m.p.h. over a measured course at sea level. After passing the gamut of full load tests she will be turned over to Pan American Airways for long range workout in the Caribbean.

ANOTHER TRANSPORT GOES ABROAD

A new model of the Northrop Delta with a 550-hp. Pratt & Whitney Hornet and Hamilton Standard propeller is the latest equipment on Sweden's airline—AB Aerotransport. The eight passenger all metal monoplane is similar to the Delta recently delivered to Aeovias Centenles for Mexican service.

was technical, not political, and that their findings should be restricted to recommendations in regard to the national defense functions of the War Department. Immediate cause of the appointment of the committee was the wave of accusations that military pilots were not adequately trained which swept over the country when the Air Corps first attempted to fly the mails

It is expected that the committee's report will be used as the basis for determining an Air Corps policy, a question upon which the Air Corps, the General Staff and Congress are in vehement disagreement at present. [AVIATION, March, page 94, April, page 119]

Services buy planes

Another disagreement about procurement methods came out of the report of Representative Rogers, chairman of the House subcommittee investigating War Department aircraft purchases (AVIATION, April, page 118) when a majority of the committee refused to sign it. Based on the opinion of the Army's Judge Advocate General and Comptroller McCarl that buying airplanes in quantities by negotiation is contrary to the intent of Congress and in violation of the law, the Rogers report condemns the policy of Army Air Corps officials and heartily endorses Assistant Secretary of War Woodring exponent of competitive bidding. Although the subcommittee was strongly in favor of adopting the competitive bidding policy, it was reluctant to sign a report passing judgment on the conduct of the individuals involved in the inquiry. In this instance, as in others when the procurement law has been in question, there were conflicting legal opinions on how the law should be interpreted. An assistant to the Comptroller General and an officer of the Judge Advocate General's office both held that the Air Corps could be justified in its policy of negotiated purchases.

The upshot of the matter was that the committee finally agreed on a modified version of the report, and authority was thereupon given to go ahead with the issuance of new bid invitations for the purchase of 46 Army bombers under the PWA allotment of $7,500,000. The first set of bids had been rejected upon the outbreak of investigation. In the new invitations the War Department will not only specify minimum requirements but will also specify just what weight will be given to performance and what weight to price in awarding the contracts.

The case in defense of the negotiated contract method of airplane procurement was strongly voiced by Representative Ross A. Collins, chairman of the Army Appropriations Bill Committee. Arguments: Negotiation can be regulated to minimize the opportunity for proceeding contrary to the public interest. Inasmuch as the art of aeronautics is still in a state of constant development, airplanes have not yet reached the stage where rigid standard specifications can be applied. If Manufacturer A demonstrates that he is the sole producer of an advanced type of airplane desired by the services, and if his price is reasonable, why delay the purchase for months until Manufacturers B and C can equip their plants with the patterns, forms and special appliances necessary for the production of this particular plane?

While the War Department and the investigating committees disputed the question of how they should buy their planes, the Navy had gone ahead with the expenditure of PWA's $7,500,000 (AVIATION, January, page 27) under the negotiated bid policy. Their purchases include 21 P2Y-3 patrol planes equipped with Wright Cyclones bought from Consolidated Aircraft Corporation for $2,244,794; 17 Great Lakes BG1 dive bombers with Pratt & Whitney engines ($673,271); 3 RD Douglas amphibions and 5 R4C-1 Curtiss Condors ($270,800); 5 JF-1 utility planes with P&W engines (see page 160) from Grumman ($222,672). Bids have been asked, but not opened, for 41 VN training planes. The Navy also plans to buy 27 VS scouting planes, though bids have not yet been invited. A sum of $202,495 was spent for instruments, $419,731 for radio equipment, $319,297 for controllable pitch propellers, $115,877 for engine changes, collector rings, etc., $47,466 for structural changes in planes; $174,491 for plane handling devices. The Navy's total purchases amounted to $5,030,295 leaving $2,469,705 to be expended. These planes and equipment are for replacement purposes to maintain the Navy's present 1,000 plane quota.

In the House-Senate conference about the Army Appropriation Bill (AVIATION, April, page 119) the $10,000,000 for the Air Corps requested by the President was cut in half. Of this sum, $3,000,000 will be allotted for new planes and material, $1,000,000 for fuel, $1,000,000 for research. Nothing was said of the rumored plan for a government operated Army-airplane factory.

The Special Senate Committee authorized to make a sweeping investigation of the arms and munitions industry started proceedings on April 23 under the chairmanship of Senator Nye, Progressive-Republican.

Germany builds up

Foreign Minister von Neurath's brief reply to the British Foreign Office's anxious inquiry concerning Germany's increased armament outlay (AVIATION, April, page 119) explained that the aviation expenditure should be considered not as an armament program but as a budget for the development of commercial aviation and defense against air attack. Von Neurath said that the estimated expenditure for air transport amounting to 160,000,000 reichsmarks ($63,000,000) as opposed to 77,000,000 reichsmarks ($30,500,000) for 1933, was largely for the replacement of obsolete equipment on government-subsidized Deutsche Lufthansa. Specifically, the money will be spent to replace single-engine planes with multi-engine craft, for increasing night-flying, and for extending some seasonal services through the winter, which will necessitate the installation of lighting and direction-finding systems. The 50,000,000 marks for air defense (in last year's budget only 1,300,000) is to be used for bomb and gas-proof cellars, for training squads in the use of devices to make poisonous gas harmless.

This blunt statement of Germany's intentions lent more significance to recent British conversations with France about the possibility of neutralizing the air above England, France, Germany, Holland and Belgium. The British proposed that these nations agree that there be no bombing of each other and no passage of planes through their air to bomb any of them. The plan also called for a limit on fighting planes, 500 per country suggested as the minimum, and violation of the agreement would be punished by joint action. Despite these idealistic proposals, no Englishman has forgotten Baldwin's declaration in the House of Commons on March 8 that Britain, failing an international accord, would make sure that her air force be inferior to none.

The French Air Ministry recently purchased a Lockheed Electra from Anthony H. G. Fokker, foreign distributor for Lockheed (AVIATION, April, page 120). France's purchase also included the reproduction rights.

New aviation financing

The Glenn L. Martin Company of Baltimore plans to issue 325,000 shares of common stock at $11.50 a share, of which the company will receive $10 per share. Otis & Company of New York and Cleveland are the underwriters. Public offering of the stock will be made through a nation-wide banking group which includes Stein Brothers and Boyce of Baltimore and Hammons & Company of New York. The proceeds will retire the Martin Company's outstanding notes, which fall due this year. Since its inception in 1909 the company has been 100 per cent owned by Glenn L. Martin, the founder and manager. This will be the largest public offering of new industrial securities of any class since the Securities Act was passed a year ago.

The Lockheed Aircraft Corporation of Burbank, Cal., proposes to issue 86,500 shares of common capital stock in an amount not to exceed $250,000. The proceeds are to be used for building extensions, machinery and equipment, and working capital. G. Brashears & Company, Los Angeles, are to underwrite a minimum of 56,000 shares and a maximum of 81,000 shares at $2 a share net.

Annual reports

An encouraging number of financial statements for 1933 from the aviation industry are written in black ink. Profit of the Curtiss-Wright Corporation and subsidiaries totaled $135,896 after interest, development expenses, minority interests depreciation, amortization, and other deductions. This equals 12 cents a share on 1,147,491 Class A shares, and contrasts with a net loss of $596,574 in 1932 after similar charges. Gross sales fell from $12,406,720 in 1932 to $10,450,728 in 1933. Current assets on December 31, 1933, amounted to $4,663,698 and current liabilities $1,048,780 against $4,313,809 and $1,112,587 respectively in 1932. In his letter to stockholders President Thomas A. Morgan said: Unfilled orders as of March 27 totalled $6,504,700 compared with $5,345,000, as of March 31, 1933. Domestic sales during 1933 constituted 68 per cent and foreign sales 32 per cent of gross sales volume. As of March 23 there were 14,718 holders of Class A and 84,515 of common shares.

The annual report of United Aircraft and Transport Corporation showed that it received as operating revenues for the year 1933 (including transport revenues and sales of aeronautical equipment) an aggregate of $26,359,059. Consolidated net income for the year was $1,176,111, after deducting all charges, which is equivalent to 56 cents per share on the average number of shares of common stock outstanding. The first three quarters of the year showed profits of 15 cents, 35 cents and 26 cents per share, respectively. The fourth quarter showed a loss of 20 cents per share, accounted for largely by the decline of earnings in the transport operations due to drastic reductions in mail pay and the seasonal falling off of passenger business. The current assets of the corporation at the end of the year were $16,037,727 and the current liabilities $2,421,517. As of Jan. 1, 1934, all the then outstanding preferred stock, of a par value of $7,500,000, was retired. This retirement accounts for a reduction in current assets as compared with the close of the previous year. Unfilled orders as of December 1931 amounted to $10,758,000 of which more than $2,200,000 were for export. During 1934 to the end of March additional orders were received totaling $2,868,669.

Consolidated Aircraft Corporation took a loss for the year of $9,135. The Glenn L. Martin Company reported for 1933 a net loss of $140,341 after taxes, interest depreciation amortization and other charges. For 1932 it reported a net income of $1,528. Current assets on Dec. 31 last were $2,428,060 and current liabilities, including $2,803,500 gold notes due in November 1934, were $4,344,387.

Liabilities immediately current exclusive of the gold notes were $1,540,887. This compares with current assets of $1,461,168 and current liabilities of $46,225 on Dec. 31, 1932.

Aid for fixed base operators

Through the formation of a mortgage loan corporation, the members of the Independent Aviation Operators of the United States (AVIATION, April, page 120) will be able to borrow on a large scale from the Reconstruction Finance Corporation, authorized by recent extension of its powers to meet such emergencies. The idea is that the RFC will lend money, through the new mortgage loan corporation to all fixed base operators who have adequate collateral in the form of real estate and equipment, and will take as security mortgages on this property. In addition the RFC will lend money toward the purchase of new airplanes. The operator is to make a down payment of 40 per cent of the purhase price, while the manufacturer will endorse his note for the balance.

Transport adds faster schedules

With its record-breaking Douglas transport, TWA recently inaugurated one-hour 45-minute service between New York and Pittsburgh, making a round trip daily. The company reports a heavy traffic volume on this run, with capacity loads and waiting lists.

To meet growing demands, Eastern Air Lines added another trip in each direction between New York and Washington. The new schedules provide five New York-Washington departures daily and four daily from Washington to New York.

Extending their Mexican service, Aerovias Centrales (Pan American) maintains tri-weekly service between Los Angeles, San Diego and Mexico City with Lockheed Orions.

Special planes barred

To the consternation of American aviators planning to enter the MacRobertson race to Australia, a recently announced interpretation of the eligibility rule prevents the entrance of airplanes bearing the "R" license of the Department of Commerce. This would bar every plane in this country that has participated in the Bendix transcontinental classic. James G. Ray, former member of the National Aeronautic Association's contest committee, was named by the association to take the matter up with the Royal Aero Club of Great Britain. The misunderstanding was cleared up when the race committee sent word from Australia that it would allow any plane approved by the U. S. Department of Commerce to compete.

Private flying

Latest development in the Aeronautic Branch's new deal for private flying, which has resulted in considerable relaxation of the Air Commerce Regulations (AVIATION, January, page 25) is the amendment providing that student pilots who are required to have 25 hours solo for an amateur license or 50 hours solo for the private grade may log part of this experience accompanied by private, limited commercial, or transport pilots. The student must, however, accomplish ten hours of strictly solo flying before he can begin to count his hours of flight with licensed pilots. These ten hours may be claimed only when the student is the sole manipulator of the controls during the flight including take-off and landing. The amendment also requires that the student pass an oral examination of the Air Traffic Rules before making his first solo flights. Redefining solo time, the amendment states that "as used in these regulations a person is engaged in

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MAJ. WILLIAM J. HAMMER, scientist and aeronaut, died in New York City on March 24. One of the staunchest supporters of the revolutionary idea of flight by heavier-than-air craft, he made notable contributions to aeronautics in the field of electrical engineering. Among his early inventions was a system of signaling from captive war balloons by means of incandescent electric lamps. He invented also colored phosphorescent substances to be used for signals, numbers, and landing stages for flying fields. During the World War, Major Hammer served on the General Staff in the Inventions Division and later in the Operations Division of the Army War College.

MAJ. GEORGE OWEN SQUIER, U.S. Army, retired, died in Washington on March 24. Pioneer in military aviation, he directed the purchase of the first Army airplane in 1909 and served as Chief of the U.S. Air Services during 1916-1918, contributing greatly to the development of equipment and personnel for the American air forces during the World War. Major Squier was likewise internationally known for his electro-physical researches.

WILLIAM THAW, 2d, World War ace, died in Pittsburgh on April 22. He was the first American to be named commander of the famous French squadron Lafayette Escadrille and later became leader of the Third Pursuit Group of the American Army.

solo flying when he is in command of aircraft in flight."

Applicants for private pilots' licenses who have 100 or more solo hours received the glad tidings that in the future they may be exempt from the spin test requirement provided they satisfy the department inspector that they have previously performed solo spins. This announcement comes as a great relief to those faced with the necessity of procuring a plane suitable for spinning and refreshing their experience with that maneuver in order to demonstrate a competence which they had acquired years ago and had no recent need of employing in modern touring planes.

Hereafter, student license applicants must take the $10 physical examination covering all requirements for the commercial as well as the non-commercial grades. If the applicant is found to be physically qualified for a transport or limited commercial license, the medical examiner will issue a student license with a notation certifying to that fact.

Renewal physical examinations for non-commercial licenses are now required only at two year intervals, and have been reduced to $6. Formerly, the private pilots paid $7.50 each year for a physical examination. Since the new rulings are not retroactive, private pilots seeking renewals must continue to take yearly physical examinations (at the $6 rate) until December, 1934, one year after the amendments were placed in effect. However the two year ruling has applied to amateur pilots since Dec. 7, 1933.

Pilots licensed in the commercial grades pay $6 for renewal examinations every six months, whereas formerly they paid $7.50 a year for full examination plus $5 for mid-year checks.

The Aeronautics Branch also announced that private and amateur pilots, mechanics, parachute riggers and ground instructors may obtain yearly license renewals by mailing their applications instead of presenting them personally to certified Department of Commerce field inspectors as was customary in the past.

CWA Airports

The latest census taken of airport and landing field projects undertaken by the Department of Commerce, whose representatives are co-operating with the local administrators of the Civil Works Administration (AVIATION, January, page 25, February, page 53) places the total at 803. About 60 per cent of this construction work is on entirely new fields, while much of the rest is for the improvement of old landing fields which had been abandoned because of inadequate facilities. A total of 391 of the 808 are at cities of 5,000 or more population, and 417 at communities of less than 5,000 or more population. They are sprinkled over 48 states, Montana winning high place with 71, Alabama and Florida practically tied with 56 and 51 respectively, and North Dakota in fourth place with 42. Least airminded states in the Union are Maryland with one lone project and Rhode Island and Minnesota with two apiece. About 1,400 additional sites have been proposed and approved, and although the Civil Works program is being brought to a conclusion, the work will continue under the sponsorship of individual states as part of the Federal Government's decentralized work relief plan. Auxiliary to the airport projects is air marking of roof tops for guidance of pilots in flight. It is estimated that beween 8,000 and 10,000 towns will have been so marked by May 1.

An official announcement of last December notwithstanding, the Civil Works did not specifically set aside $10,000,000 for the Department of Commerce airport program. The funds that are being used in the work are allotted at the discretion of local CWA administrators from their total allotments.

SAE laurels

At the conclusion of the annual meeting of the Society of Automotive Engineers two outstanding awards for engineering work in advancement of the science of aviation were made. A. H. Roy Fedden of the Bristol Aeroplane Company, Ltd., of England, received the Manly Memorial Medal, which is awarded annually to the author of the best paper relating to theory or practice in the design or construction of aeronautic power plants. The Wright Brothers Medal was presented to E. N. Jacobs of the National Advisory Committee for Aeronautics. The medal is awarded annually for the best paper on aerodynamics or structural theory or research, airplane design or construction. Conditions of the awards specify that the papers must have been presented to the S.A.E. during the previous year.

WHAT OUR READERS SAY

The Air Defense League Writes

[One of the minor excitements of Washington during the past three months has been the persistent attempt to put into the widest possible circulation a series of "charts" prepared by Mr. Chessborough J. H. MacKenzie-Kennedy and purporting to prove the hopeless inferiority of American aircraft and engines to those of European design. As the charts have never been made the formal subject of official inquiry there has been no opportunity of offering formal rebuttal or disproving their somewhat extraordinary claims, but they have received wide attention. There has been an impression in some quarters, as the result of certain publications in newspapers, that the Air Defense League (an organization centered in Philadelphia and concerned with promoting proper air defense and arousing public interest therein) has been in some way responsible for the circulation of the MacKenzie-Kennedy material, or that the League has given the charts its sponsorship. To clear up any misapprehension on this point the president of the League writes to us as below, and we are very glad indeed to present this very specific disavowal of any responsibility for Mr. MacKenzie-Kennedy's allegations regarding American aircraft and of any interest in extending their circulation.]

To the Editor of AVIATION:

Thank you for the generous offer you have made to publish in your magazine a statement of the true facts concerning Air Defense League and C. J. H. MacKenzie-Kennedy. This man was introduced to me and the secretary of the league jointly sometime in the fall of 1933 by a member of Congress, who at that time, showed us the MacKenzie-Kennedy charts that have caused the present controversy. This was the first time we had ever heard of MacKenzie-Kennedy.

Our contacts with Mr. MacKenzie-Kennedy have been limited to occasional meetings in Congress, and we do not know him sufficiently well to feel justified in endorsing him.

We have never discussed with him any subjects in detail, nor endorsed his charts, other than to say that they were interesting and that "we accepted them for what they were worth."

Mr. MacKenzie-Kennedy has sent us copies of a number of letters and has apparently used our name a number of times but entirely without our sanction.

Like a great deal of other information, the MacKenzie-Kennedy charts are in our files, but we do not vouch for them. The information that we have on Mr. MacKenzie-Kennedy himself has also been collected from public records.

Air Defense League has no brief for or against this gentleman, and only regrets that it has been named in the controversy. After all, our only object is to secure for this country an adequate, co-ordinated national air defense and we are bending all our energies to that end.

SAMUEL P. WETHERILL, *President*
Air Defense League
Philadelphia, Pa., April 26, 1934

FLYING EQUIPMENT

Night and Day

TO many travelers the idea of spending a night in an airplane is far from new. It has remained however for the Curtiss-Wright Airplane Company, working in close co-operation with American Airways and Eastern Air Transport to translate 70 years of railway sleeper experience into the air. Since October last, Eastern Air has been operating one Condor between Atlanta and Newark with an experimental sleeping section installed, but the first ships to be built from scratch with convertible day-and-night accommodations are the six new Cyclone-powered Condors ordered by American Airways. For many months, working in the privacy of a walled off corner of the Curtiss-Wright plant, President Ralph S. Damon and his associates have been working on the problem of applying modern sleeper equipment to the plane. Their researches were a good deal more than theoretical for many of them spent many nights sleeping in the full-scale mock-up, trying out the general comfort of the berths and exploring the possibilities for dressing and undressing in the space available. A very Pullmanesque atmosphere has been achieved even down to the familiar net hammocks, overhead baggage racks, and sliding curtains. Berths are 28 in. wide and are 1 in. longer than standard railway practice. Each is equipped with reading lights individually controlled, warm and cold air supply, coat hangers, service call buttons etc. Everything has been worked out to give a maximum of comfort for night flight and an ease of conversion for normal day-time operation. Twelve passengers can be accommodated—night or day.

Pullman comfort for airline passengers. A standard sleeping section as installed in the new Curtiss-Wright Condors for American Airways. The berths are quickly convertible for daylight use to the seating arrangement shown at the left.

Far-sighted railway executives long since recognized that the traveling public appreciates pre-cooled and air conditioned railway cars. Again following railway practice, Curtiss-Wright and American Airways in collaboration have developed a portable air conditioning apparatus for use with the new Condor sleepers. Heating and ventilation for a ship in flight are no longer serious problems but for a plane standing on the ground there is no exhaust heat and no forward speed to provide warmth and air circulation for the cabin. The new air conditioning unit is a combination electric refrigerator, electric heater and ventilator, thermostatically controlled to maintain comfortable cabin temperatures and to insure a complete change of cabin air every two minutes. Mounted on casters it can be placed under the belly of an airplane standing on the ground and pipe connections made to the regular heating and ventilating ducts of the ship. Power is supplied through a rubber-covered cable which can be plugged in to some convenient outlet.

The planes themselves are the latest revision of the T-32 Condor, embodying the many improvements which were discussed in connection with the BT-32 Bomber in AVIATION for February. With a combined horsepower of 1,470 from the two Wright Cyclones, the new ships are reported to show a top speed of 190 miles an hour and will cruise at 160. American Airways plan to use the first six machines for night operations between Dallas, Fort Worth and Los Angeles.

Air conditioning unit under Curtiss-Wright sleeper.

New Fairchild for Three

AFTER an extensive survey of the requirements of potential private owners, Fairchild Aviation officials come to the conclusion there is a definite place in the American market for a machine between the two-place, high-speed cabin class and the more luxurious four to six-place ships. Their answer is incorporated in a new cabin monoplane in which the objective has been to provide an airplane to carry three people comfortably, yield high performance from relatively low power and incorporate maintenance and struc-

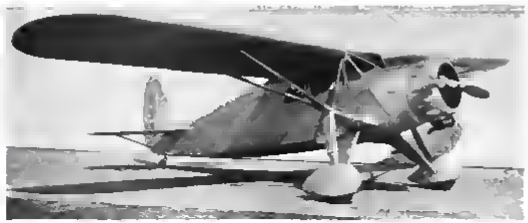
tural features to materially reduce the cost of operation

The cabin is arranged with two seats forward, side-by-side (dual control) with the third passenger directly to the rear on a seat which can be folded back out of the way to make room for luggage or other types of loads as desired The high wing design and the ample windows insure adequate vision both for passengers and pilot Cabin walls are Seapak insulated and the interior is upholstered in leather Chair cushions can be removed if parachutes are to be installed The instrument board is rubber mounted and exhibits the usual assortment of flight and engine indicators Stabilizer control is overhead and the throttle is located on the board between the two front seats.

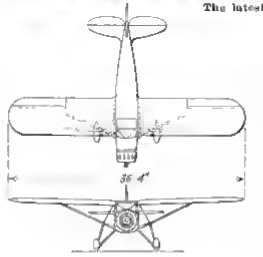
The ship is designed around the Warner Super-Scarab engine rated at 145 hp at 2,050 r p m Hamilton Standard propeller (diameter 91 in.) is standard equipment. With this power plant the ship is reported to show a top speed of about 145 m p h at sea level, cruises at 126 m.p.h. on 8½ gal of fuel per hour Under these conditions, the cruising range is about 600 miles

The landing gear is of the usual split-axle type with a tread of 9 ft 3 in Shock absorbers are of the oleo-spring variety and have a total travel of 8 in All connections in the landing gear system are equipped with removable bronze bushings Sheet dural fairings and wheel pants cover the entire assembly

Wing beams and ribs are of spruce Steel tubes, struts and ⅛ in square wires make up the drag bracing system All bolt holes through the spars are duralumin bushed The leading edge is plywood under the fabric covering Great care has been taken to prevent rust and corrosion in all internal wing parts Steel struts are coated with baked-on enamel, dural members are anodically treated and other wing fittings are cadmium plated Ailerons are of heat-treated duralumin They are hung to the rear spar by means of steel brackets with hinges fitted with self aligning, grease-sealed, ball bearings



The latest Fairchild 24, a three-place cabin cruiser



All other parts of the control system are also fitted with ball bearings.

The general specifications as furnished by the manufacturer are: Span 36 ft. 4 in ; length overall 23 ft. 9 in ; height overall 7 ft. 3 in , total wing area, 186 sq ft ; weight empty, 1,354 lb , useful load 796 lb , normal gross weight 2,150 lb , wing loading 11.55 lb per sq ft , power loading 14 0 lb per hp

New Ships for the Navy

AMONG photographs recently released by the Navy Department, are two which show the trend of latest sea-going flying equipment. In the fighter classification, the Curtiss XF11C 3 shows a number of interesting details, among which perhaps the most important is the fully retracting landing gear. The ship is fitted up with all the necessary equipment for working from carrier bases Its power plant is the Curtiss-Wright Cyclone of 700 hp

Grumman Aircraft Engineering Corporation is working on orders for a number of high performance general utility amphibians, XJF-1 series A Pratt & Whitney Twin Wasp furnishes the power. The ships are designed for catapulting, deck-landing, and flight from the open water, and are fitted up with an unusually extensive complement of radio and photographic equipment Among its other functions, the XJF-1

Above: Curtiss XF11C-3, with 700-hp Wright Cyclone engine for carrier operation Lower: A general purpose amphibian—the Grumman XJF-1 with the Pratt & Whitney Twin Wasp engine

General Aviation's GA-43 makes its first appearance as a seaplane for Seadta.

might also be used as a rescue ship in emergencies It carries an inflatable raft and can accommodate two extra persons inside the hull, in addition to the normal crew of pilot and observer.

Model D Monocoupe

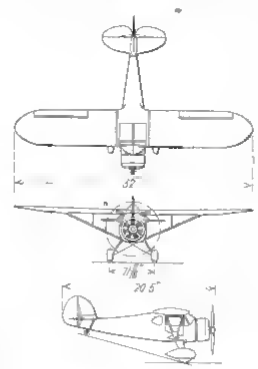
EASILY recognizable as a member of the Monocoupe family, but carrying numerous features that heretofore have been reserved for the racing classifications, the Model D, with its 145 hp. Warner Super-Scarab engine, offers a number of refinements of interest to the sportsman pilot. A great deal of attention has been paid to details of fairing, especially around the landing gear and at the intersection of bracing members with the wing or fuselage For example, advantage has been taken of the large fillets at the outboard strut connections to house the landing lights The lines of the landing wheel fairings taper down to include the shock struts and are carried into the fuselage without a break. The single undercarriage members on each side are wire-braced to the fuselage. A combination N.A.C.A. and tunnel type cowl provides effective streamlining at the nose and maintains cylinder head temperature well below the maximum allowable limits.

With the new power plant and the improvement in fairing, a high speed of 165 m.p.h is reported with a normal cruising speed of 140 m.p.h. Cruising (1,925 r.p.m.) fuel consumption is between 8 and 8.5 gal. per hour, or approximately 17 miles to the gallon

Seating accommodations have been considerably improved over prior models by the widening of the cabin by 6 in. A new ventilating system has been installed which takes air from ahead of the engine and delivers it to a manually controlled ventilator in the rear of the cabin roof The window by the pilot seat may also be opened from the bottom outward Pilot and passenger vision in essential fields has been improved by covering certain sections of the wing roof and the entire cabin roof with transparent Plastacele The instrument board which carries the usual engine and flight indicators is also large enough to accommodate the additional equipment required for blind flying Controls are of the usual dual stick type. The working parts of the control system are easily available for inspection by dropping a large metal cowling covering the under portion of the fuselage. In this model the stabilizer is fixed and longitudinal balance is obtained by means of a small tab in the trailing edge of the elevator operated from a lever located at the left side of the cabin

Fuselage, wings and tail surfaces are of usual Monocoupe construction, with welded steel tubing for the fuselage framework and the wings principally of wood Except around the nose, the covering is fabric throughout

Standard equipment includes instruments electric starter, battery, Hamilton Standard propeller, wheel pants, brakes, and radio bonding The general specifications as given by the manufacturer are: span, 32 ft , length overall, 20 ft. 5 in., wing area, 129.7 sq ft ; weight empty, 1,228 lb , gross weight, 1,860 lb



GA-43 into Seaplane

THE GA-43 transport is a wanderer in the far corners of the earth The first machine delivered flies the rugged Alpine routes for Swissair, the second travels the airlines of Japan Another shuttles back and forth over General Aviation's Mid continent Division, between Cheyenne and Albuquerque, and the fourth, just completed, is destined to serve the Magdalena River country in Colombia (S A), for Pan-American controlled Seadta Airlines First three machines were land planes with retracting wheel gear (AVIATION February, 1933), the last is rigged as a twin-float seaplane.

The floats are Edo's standard Model 36 9225, similar in shape to those used on Colonel Lindbergh's Lockheed Sirius. They are each 28 ft 9 in long, 3 ft 8½ in wide and 3 ft. 1 in maximum depth, dural and Alclad built, fitted with seven watertight compartments each The usual Edo retracting water rudder equipment is also fitted. The mounting arrangement, however derives directly from German seaplane practice rather than American Each float is suspended independently by a series of struts connecting it with the wing There are no inter-connecting spreader tubes and no bracing wires whatever

The Seadta ship is arranged for ten passengers and two pilots plus an ample allowance of mail and express Cabin accommodations and arrangements are similar to those described in an earlier issue of AVIATION The principal innovation beyond the seaplane adaptation

The new two place Monocoupe with its 145 hp Warner Super-Scarab engine

is in the fitting of trailing edge flaps to act as decelerators or "air brakes" for landing. With a 700-hp Pratt & Whitney Hornet engine swinging a Hamilton standard controllable pitch propeller, the top speed is reported to be in excess of 165 m.p.h. With the aid of the flaps, the landing speed is said to be in the neighborhood of 60 m.p.h.

ALL THE WORLD'S AIRCRAFT, 1933. *Edited by C. G. Grey and Leonard Bridgman, Sampson Low, Marston & Company, Ltd.; London, 1934, 590 pages, $11 approximately.*

A STANDARDIZED annual of this sort must follow very much the same form year after year, and it is hardly possible to find anything to distinguish the current volume in principle from its predecessors. Like them it will be accepted as a necessary tool for constant use by every engineer and constructor of aircraft and engines, by all writers on aeronautics or students of aeronautical developments, and by large-scale operators who want to compare their own activities with those of similar enterprises in other countries. The historical section is particularly good, and air transport seems to be covered perhaps a little better than ever before. Though Mr. Grey in his preface expresses regret that the secrecy policy of our Army and Navy makes it impossible to give the extended performance data on American military planes that have been offered in past years, still there need be no apology for the American section. It errs only in including the products of some companies that are no longer in business, but that is merely an evidence of the determined quest after completeness. Broadly speaking, this volume includes all of the American products upon which there has been any public release of information up to November, 1933.

As upon several past occasions, the review must close with a formal but nevertheless intensely sincere expression of regret that it seems to be impossible to undertake the compilation and publication of such a book as this by any agency in America.

L'ANNEE AERONAUTIQUE, 1932-33. *by L. Hirschauer and Charles Dollfus. Dunod & Company, Paris, 1933, 403 pages, $3 approximately.*

THE ANNUAL compilation of the events of French and incidentally of foreign aviation comes to take its customary useful place among reference volumes. The content is much the same as in past years, except that the discussions of government organization and of military aviation are missing. The directory of the French aeronautical industry is more complete than ever before, and there is also very satisfactory listing of foreign manufacturers and their addresses. The listing of notable flights is, as in the past, incomparable in its completeness and accuracy, including an excellent selection of the best American performances of the year. That really constitutes the most useful part of the book, though the statistics of world air transport are also the best that are anywhere to be found within a single set of covers. The tabulation of important new airplanes, though it includes only 30 machines in all, is more satisfactory than often in the past in that there has been a fairer distribution between French and foreign products. Just a half of the total number are French, and America is represented by the Gee Bee and Wedell-Williams racers, the Northrop Gamma and the Boeing transport, a larger relative participation than the reviewer can recall having been assigned to this country in any previous year.

AIR ANNUAL OF THE BRITISH EMPIRE 1933-34. *Edited by Squadron-Leader C. G. Berge. Putnam Publishing Corporation, New York and London 1933, 718 pages. $6.*

THE FIFTH volume of a well-known aeronautical annual follows the general course established by its four predecessors and maintains their high standard of excellence. Statistics are complete as in the past, and the British aircraft industry and its products are reviewed at greater length than ever before. The technical articles which have played a large part in past volumes have been practically eliminated this year, the present issue containing only five signed features and practically all of those dealing specifically and exclusively with British interests and activities. Another indication of the increasingly national, or imperial, point of view is an increasing tendency to editorialize, especially in a preface dealing with British air policy and the limitation of air armament.

Again as in the past, we sum up the case by paying tribute to an excellent piece of compilation very carefully done—one of the few really important reference manuals that should be within reach of the hand of everyone who pretends to any interest in the course of aeronautical developments outside his own country. Each existing aircraft design, whether military or commercial, that proceeds from any of the great British factories is covered by photographs and from a page to three pages of descriptive text and specifications and in many instances by drawings as well and engines are treated with corresponding completeness.

One feature that commands special praise is the illustration, for the plates have been more carefully selected than ever before both for technical clarity and for artistic value, and have been printed upon a greatly improved paper with really exquisite results. Surely there never has been a finer collection of aeronautical photographs.

SAILPLANES, *by C. H. Latimer Needham, Chapman & Hall, Ltd., London 1933; 263 pages; $3.25 approximately.*

WITH the annual soaring contest firmly established as a feature of American aeronautical sport, and with gliding again receiving serious consideration as a means of preliminary training for airplane pilots and also of indoctrination in atmospheric irregularities for pilots already expert, a book on soaring flight is needed. Most of the American ventures in the field have suffered from being too elementary, too consciously addressed to schoolboys ambitious to build their own gliders. Mr. Needham writes in a very different style, for he concentrates upon the high efficiency sailplane to the virtual exclusion of primary training types, and he assumes that his readers are intelligent men with some knowledge of engineering and of aircraft. That enables him to plunge directly into such questions as the structural analysis of wings and the methods of testing for liability to flutter, and then to proceed through a series of descriptions of existing machines to a treatment of methods and materials of construction. The constructional section is illustrated with many drawings, a little more diagrammatic and less detailed than one might wish, and is in turn succeeded by several chapters on operation and on how to find and take advantage of the desired air currents for soaring. At least for those who do not read German this undeniably stands as the No. 1 reference now available.

SERVICING SHORT CUTS

Aerial Platform

THE inspection, repair and cleaning of the upper wing panels of large biplanes is always a problem due to their relatively great height above the floor of hangars. It will be recalled (AVIATION, February, 1933, page 62) that a sort of bosun's chair device was suspended from an overhead trolley rail in the Cheyenne shops of United Air Lines for convenience in getting at the top wing surfaces of the Boeing 80s formerly in use. The same problem has been solved in a somewhat different manner by Eastern Air Transport at the Atlanta Depot. A portable platform has been developed which makes it convenient for mechanics or inspectors to reach all parts of the wing and nacelle structure independent of any overhead support. It is thus possible to work on the planes out-of-doors quite as easily as in hangars.

The construction and the method of using the servicing platform is clearly shown in an accompanying photograph. The main supporting member is a large steel tube with the necessary base members and steel ladders welded to it. The platform may be raised or lowered to any desired height by means of a hand crank operated from the ground and may be clamped in any position. The railing shown may be un-shipped from its sockets when full clearance is desired. Two men may work conveniently on the platform without danger of tipping it over. The entire structure is very rugged and its large casters permit easy transportation about the shop. Many uses have been found for the device. It has made possible the total elimination of unsightly and awkward ladders and scaffolding formerly required for servicing and cleaning the large ships.

This portable working platform finds many uses in servicing Eastern Air Transport Condors at Atlanta.

Automobile headlight furnishes illumination for cylinder grinding in the T.W.A. Kansas City shops.

Light on Grinding Problems

WHEN regrinding engine cylinders it is frequently difficult to get sufficient light inside the barrel to see clearly the condition of the finish. This problem has been eliminated in the engine shop of Transcontinental & Western Air at Kansas City by mounting an ordinary automobile headlamp on the spindle carriage of the Heald grinder with the beam focused into the open end of the cylinder. The light always bears a fixed relationship to the grinding wheel, and thus keeps the illumination in the right spot for all stages of the grinding operation.

Engine Heaters

OPERATING under unusually severe weather conditions in countries where hangar facilities are few and far between and where schedules may be temporarily halted on account of weather, Northwest Airways has had to develop a lightweight engine heating plant which can be carried in the ship at all times. The basic heating element is an ordinary plumber's torch placed inside a demountable fireproof chimney. This stove can be set up and operated safely under a canvas hood which completely surrounds the airplane engine. The entire outfit weighs but a few pounds and when knocked down and stowed in the baggage compartment of the airplane, occupies (with engine cover, tool-kit, gas funnel, and snow shovel) but 1½ cu.ft. of space. All ships are equipped with electric oil immersion heaters to keep oil warm while the ships are in base hangars, and extension cords are carried so that they may be used on any field where current is available.

Service Stripes

MECHANICAL personnel in the shops and service stations of Transcontinental & Western Air wear certain insignia on their working clothes to indicate their ratings. Overalls are white and carry in the middle of the back the company insignia, the letters T.W.A. in a circle, done in red. On the left shoulder apprentice mechanics wear a red circle about 2 in. in diameter. All employees receiving a certain rate of pay are considered mechanics and entitled to wear a star. Other employees at lower rates may be recommended for the star by the foreman in charge of the department if the employee possesses a Department of Commerce license. On the left forearm stripes or chevrons are worn to indicate length of service with the company. Half a stripe equals six months service and a full chevron, one year. All stars, circles or chevrons are in red braid.

A special gasoline stove keeps Northwest Airways engines warm when forced to spend the night in the open.

THE BUYERS' LOG BOOK

AVIATION'S *Card Index of New Equipment*

This department is equipped to help readers locate manufacturers of any parts, accessories or materials

AIRPLANE ACCESSORIES — **Camera gun**

Fairchild Aerial Camera Corporation
62-10 Woodside Avenue, Woodside, L. I., N. Y.

A SPECIAL Fairchild camera gun has been developed for military combat practice. In weight, appearance and in operation the camera simulates the standard fixed or flexible machine gun. Automatically registers time and location of each burst of fire on 16 mm film. Film magazines inserted like cartridge clips in automatic pistol. Can be used under wide range of light conditions.

AVIATION, *May, 1934*

AIRPLANE ACCESSORIES — **Parachutes**

Irving Air Chute Company, Inc.
1670 Jefferson Ave., Buffalo, N. Y.

LATEST Irvin equipment is a chair type parachute designed especially for transport machine use for both men and women. Chute forms part of the upholstery of the chair. Finish can be supplied to conform with any interior decoration scheme. Straps easily applied, self adjusting when passenger is seated. Chute comes clear as passenger rises. Total weight, chair-fittings, chute and harness, 16½ lb.

AVIATION, *May, 1934*

AIRPORT EQUIPMENT — **Portable lighting units**

Lakewood Engineering Company,
Columbus, Ohio

DEPARTMENT of Commerce approval has been obtained for self-contained, portable neon flasher marker beacons for runway or general obstruction marking for airports. Require no external connections. Units operate from low drain Willard storage batteries housed in cone bases or in convenient underground receptacles. Under average conditions batteries run six months between chargings.

AVIATION, *May, 1934*

ENGINES (AND ACCESSORIES) — **Catalog**

Wright Aeronautical Corporation,
Paterson, N. J.

A BEAUTIFUL booklet has just been issued describing the Cyclone Series in great detail. The book not only gives the full specifications for all models, but is copiously illustrated with photographs of all important structural features. Historical data for both engine and company have not been overlooked. Many pictures of Cyclone-powered military and commercial ships are included.

AVIATION, *May, 1934*

ENGINE ACCESSORIES — **Spark plugs (catalog)**

The B. G. Corporation
136 West 52d Street, New York, N. Y.

COMBINED catalog, specification sheet and instruction manual has been received. This bulletin contains not only descriptive material on the several types of B.G. plugs available, but discusses operating troubles and cures, and the details of maintenance and inspection procedure. The necessary tools and test equipment are also listed. Copies of the bulletin are available on request.

AVIATION, *May, 1934*

MATERIALS — **Insulating felt**

The Johns-Manville Company,
22 East 40th Street, New York, N. Y.

AN asphalt impregnated rag felt is being offered under the name "Silento" for sound insulating and vibration damping in aircraft and automotive vehicles. Very flexible, unaffected by temperatures up to 300 deg. F. Weighs 21 to 26 lb. per 100 sq.ft. Approximately 0.053 0.063 in. thick. Furnished in widths up to 40 in. either in standard length rolls, or cut to fit as ordered.

AVIATION, *May, 1934*

MATERIALS — **Magnesium alloys (catalog)**

The Dow Chemical Company,
Midland, Mich.

A NEW data book on Downetal has just been published. It furnishes material on accepted shop practices, chemical and physical properties, specifications on designing and finishing. The various forms, (sand and die castings, sheet, plate, strip, forgings, extruded sections, etc.) as well as methods of welding, riveting, forming and machining are discussed in detail. Manual available on request.

AVIATION, *May, 1934*

RADIO — **Aircraft receiver**

RCA-Victor Company, Inc.
Camden, N. J.

FREQUENCIES from 2,000 to 6,600 kc. are covered in two overlapping bands by a new aircraft receiver, Model AVR-3. It is adaptable to any modern aircraft for either remote or direct control. Operates from 12-volt battery (6-volt sets supplied on special order). Superheterodyne circuit, six tubes. Automatic volume control. Crank type tuning unit. All assemblies shock mounted and fully shielded.

AVIATION, *May, 1934*

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will maintain pressure

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Texaco Airplane Oils—for any engine—any operation—are available at airports in all our 48 States. Experienced Texaco aviation engineers will gladly help you with any lubricating problem. Write The Texas Company—no obligation.

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FOR PAN AMERICAN AIRWAYS

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Pan American Airways may be justly proud of their newest "Clipper" —the 19-ton Sikorsky S-42—largest plane ever built in the United States. This is the first of a new series of "Clippers" that will be placed in service soon on Pan American Airways routes between North and South America.

With a cruising speed of 160 miles per hour it is expected that this new Sikorsky flying boat will provide new high speed service between Miami and Buenos Aires. She will carry a crew of six, 32 passengers and 1000 pounds of mail and express for 1,200 miles non-stop.

The selection of Hamilton Standard three-bladed Controllables for this four-motored ship marks another step in the world-wide use of Hamilton Standard Propellers as standard equipment on leading commercial lines of both hemispheres.

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The Wind's on Your Tail All of the Time!

You get extra pep and power as well as smoother performance when you hitch your ship to the Mobilgas-Mobiloil team

WHEN your engine takes the bit in its teeth and shows its true spirit . . when your ship surges up with a rush . when you get tail-wind speed wherever you go . . . that's when flying is *fun!*

That's the performance that aviation Mobilgas gets—and *keeps*. It has "Chmatic Control"—that scientific preadjustment of gasoline components that holds your engine to a perfect stride *always*—regardless of weather, temperature and atmospheric pressure changes.

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Try this prize-winning gas and oil combination that took Wiley Post around the world—that has enabled many sportsmen pilots to beat their own records.

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Pioneer Tachometer of the centrifugal type accurately and smoothly indicates the R.P.M. of the engine to which it is attached by means of a flexible shaft. Universally established as the most important instrument of the engine group, the Pioneer Tachometer may be identified on the major portion of airplanes produced within the past ten years * Type 347B retains the original Pioneer design and method of operation. However, many important refinements have been added to increase the efficiency and wearing qualities of this instrument * A new dial with evenly spaced graduations and the new transport pointer, greatly increase the readability of this instrument. * Precision-ground jewels and ball bearings minimize friction and wear, and add to the unusually smooth operation of the actuating mechanism * Carefully selected materials, precision workmanship, rigid vibration and temperature tests ..all are combined to assure perfect operation and constantly satisfying service * Pioneer Tachometer 347B embraces in proper balance, all the performance and wear-resisting features for which Pioneer Instruments are famous

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Specifications and actual performance data are interesting; write for them today.

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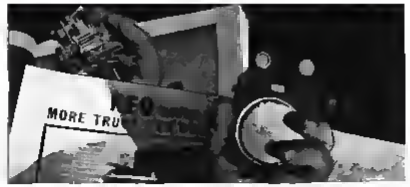

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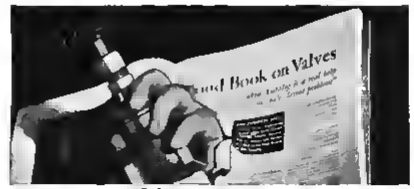

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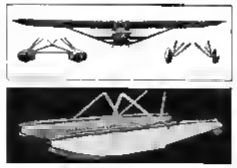

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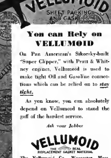

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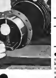

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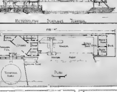

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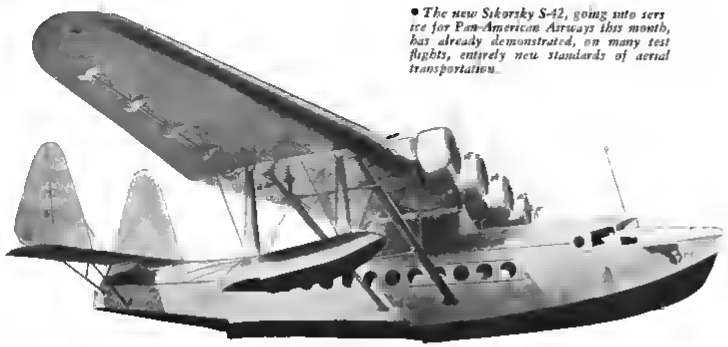

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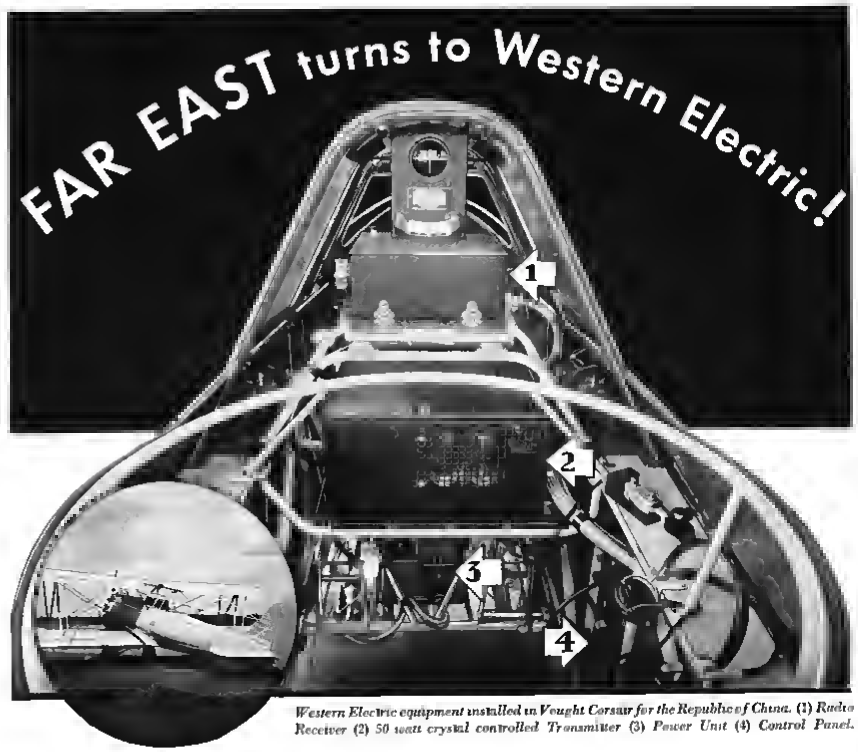

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